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6011A

Synthesized Signal Generator

Instruction Manual

FLUKE®

NOTE

This manual documents the Model 6011A Synthesized Signal Generator and its assemblies at the revision levels shown in Appendix 7A, Table 7A-1. If your instrument contains assemblies with different revision letters, it will be necessary to either update or backdate this manual. Refer to the supplemental change/errata sheet for newer assemblies, or the backdating sheet for older assemblies.

6011A

Synthesized Signal Generator

Instruction Manual

P/N 424796
August 1978

FLUKE®

WARRANTY

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SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

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CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC, will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX 43210, MOUNTLAKE TERRACE, WASHINGTON 98043, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

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John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, Washington 98043

Rev. 4/80

CHANGE/ERRATA INFORMATION

ISSUE NO: 4 7/81

This change/errata contains information necessary to ensure the accuracy of the following manual. Enter the corrections in the manual if either one of the following conditions exist:

1. The revision letter stamped on the indicated PCB is equal to or higher than that given with each change.

2. No revision letter is indicated at the beginning of the change/errata.

MANUAL

Title: 6011A Synthesized Signal Generator
Print Date: August 1978
Rev. and Date: -----

C/E PAGE EFFECTIVITY

Page No.	Print Date
1	7/79
2	7/79
3	2/80
4	7/81

CHANGE #1-11967
Rev.- L, A2 Main PCB Assembly

On page 5-12:
FROM: CR5|DIODE, ZENER, ±5%, 15V|266601|07910|1N965B|2|1
TO: CR5|DIODE, ZENER, +10% 16V|113332|07910|1N966A|2|1

FROM: CR6|DIODE, ZENER, ±5%, 15V|266601|07910|1N965B|REF.
TO: CR6|DIODE, ZENER, +10%, 16V|113332|07910|1N966A|REF.

On page 8-13:
FROM: CR5,CR6,15V
TO: CR5,CR6,16V

ERRATA #1

On page 8-20:
FROM: C79, 500 pF
TO: C79, 1500 pF

ERRATA #2

On page 5-27:
ADD: Flag note "1" to the end of Item No. U14.
ADD: The following note to the end of the page:

1 If the -02 or -03 Options are installed, the TCXO (U14) will be mounted on the PCB of that option.

On page 601-1/601-2:
ADD: The following note to the end of paragraph 601-2:

NOTE

If the -02 or -03 Options are installed, the High Performance TCXO will be found on that option's PCB.

ERRATA #3

On page 4-32:
FROM: ±2V
TO: ±0.2V

CHANGE #2-12098
Rev.-R,A3A1 Input/Output PCB Assembly (6011A-4001)

On page 8-15:
Electrically connect U2-14 to U2-13, if not already connected.

CHANGE #3-12302
Rev.-S, A3A1, Input/Output PCB Assembly (6011A-4001)

On page 5-19:
Change TOT QTY of C11, FROM:5 TO:6

On page 5-21:
ADD: C129|CAP, CER, 0.22UF±20%, 50V|309849|71590|CW30C224K|REF

On page 5-29 and 8-14:
ADD: C129 and its symbol between C51 and R126

On page 8-15:
ADD: C129, .22uF across (in parallel) C51

CHANGE #4-12004

On page 5-3:
FROM: H8|SCREW, PHP, 6-32 X 5/8|152181|89536|152181|4
TO: H8|NUT, CAP|170571|73734|8061-NP|4

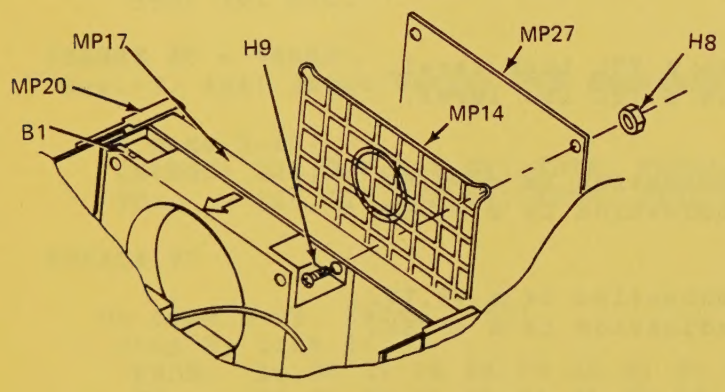
FROM: H9|NUT, KEP, 6-32|152819|78199|511-061800-00|11
TO: H9|SCREW, PHP, 6-32 X 1|114215|89536|11421S|4

ADD: H28|WASHER, EXTERNAL LOCK, #4|169235|73734|1322|8
ADD: H29|WASHER, FLT, #8|110270|73734|1406|4
ADD: H30|NUT, 6-32|110569|73734|70206|4

On page 5-4:
FROM: MP14|FAN, GUARD|407650|82877|476042|1
TO: MP14|FAN, GUARD|445494|82877|550481|1

ADD: MP27|FILTER, AIR|501015|60399|30208|1

On page 5-6, change Figure 5-1 as shown in Figure 1:



NOTE
Parts not shown imply no change.

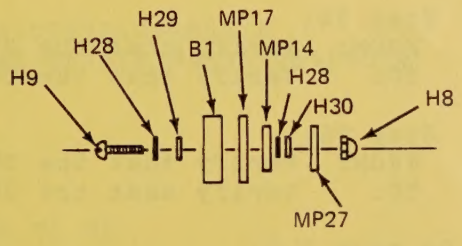


Figure 1

CHANGE #5 - 12662
Rev.- M, A2 Main PCB Assy (6011A-4004)

On page 5-12:
FROM: CR5|DIODE, ZENER, 16V|113332|07910|1N966A|2
TO: CR5|DIODE, ZENER, 16V, 5%|325837|07910|1N966B|2

FROM: CR6|DIODE, ZENER, 16V|113332|07910|1N966A|REF
TO: CR6|DIODE, ZENER, 16V, 5%|325837|07910|1N966B|REF

ERRATA #4

On page 4-25, Para. 4-65, Step 5:
FROM: ... is at least 0.38V
TO: ... is at least <0.38V

On page 4-28:
Add the following note under Para. 4-68:

NOTE

In most cases the 6010A-7001K Service Kit will simplify troubleshooting. Refer to section 6 of this manual for additional information.

ERRATA #5

On page 2-7, Para. 2-30:

FROM: Where V_{AMIN} is equal to the peak value of the input ...
TO: Where V_{AMIN} is equal to the peak-to-peak value of the input ...

ERRATA #6

On page 5-8:
FROM: MP1|Panel, Front|Order Next Higher Assy|
TO: MP1|Panel, Front|412486|89536|412486|1

On page 4-33, Para. 4-95:
Step 11:
FROM: Verify that TP1 goes to a TTL high level.
TO: Verify that TP1 goes to a TTL low level.

Step 24:
FROM: Verify that the DVM indication is a +0.5V.
TO: Verify that the DVM indication is a +1.5V.

Step 26:
FROM: Verify that the DVM indication is a +2.7V.
TO: Verify that the DVM indication is a +1.5V.

On page 5-9:
Change the mfg sply code for H2, FROM: 73734, TO: 86928 .

CHANGE #6 - 14392
Rev.-G, A5A1 Attenuator PCB Assembly (6011A-4003)

On page 5-44:
ADD: MP3|LUG, SOLDER (NOT SHOWN)|169763|79963|334|1

CHANGE #7 - 14455
Rev.-G, A9 IEEE General Purposes Interface PCB Assembly (6010A-4008T)

On page 605-10:
CHANGE: C1|CAP, PLSTC, 0.1 UF ±10%|161992|89536|161992|1
TO: C1|CAP, TO, 2.2 UF ±20%, 15V|364216|56289|196D225X0015HA1|1

CHANGE: R1|RES, COMP, 390 ±5%, 1/4W|147975|01121|CB3915|1
TO: R1|RES, DEP CAR, 620 ±5%, 1/4W|442319|80031|CR251-4-5P620E|1

On page 605-11/605-12 and 8-32:
Change the drawing as shown in Figure 2:

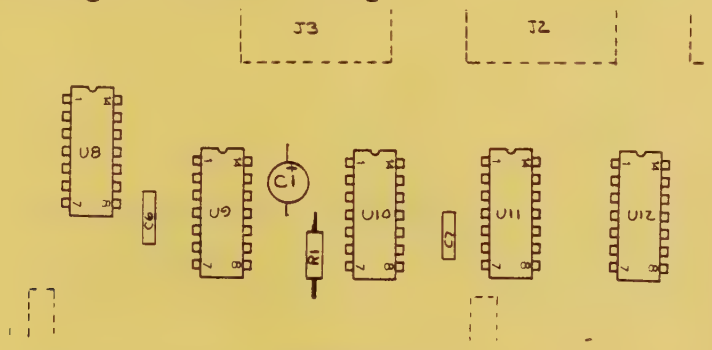


Figure 2.

On page 8-33:
Change the value of C1, FROM: 0.1, TO: 2.2 and the value of R1, FROM: 390, TO: 620.

CHANGE #8 - 14662
Rev.-T, A3A1 Input Output PCB Assembly (6011A-4001)

On page 5-24:
CHANGE: Q25,Q27,Q28,Q31|XSTR, FET|428169|07910|02366E|4
TO: Q25,Q27,Q28,Q31|XSTR, FET, N-CHAN|261578|89536|261578|4

ERRATA #7

On page 2-13, Para. 2-59:
Step 3, line 2:
FROM: A9 B8 C7 D6 E5 F4 J5 W4 O4 R2 S4 T6 U0
TO: B9 C8 D7 C6 F5 G4 J5 W4 Q4 R2 S4 T6 U0

ERRATA #8

On page 2-14, Para. 2-65:
Step 1:
FROM: 1045 E 3 H is entered, 10.45000 MHz is displayed.
TO: 1045 E 3 H is entered, 1.04500 MHz is displayed.

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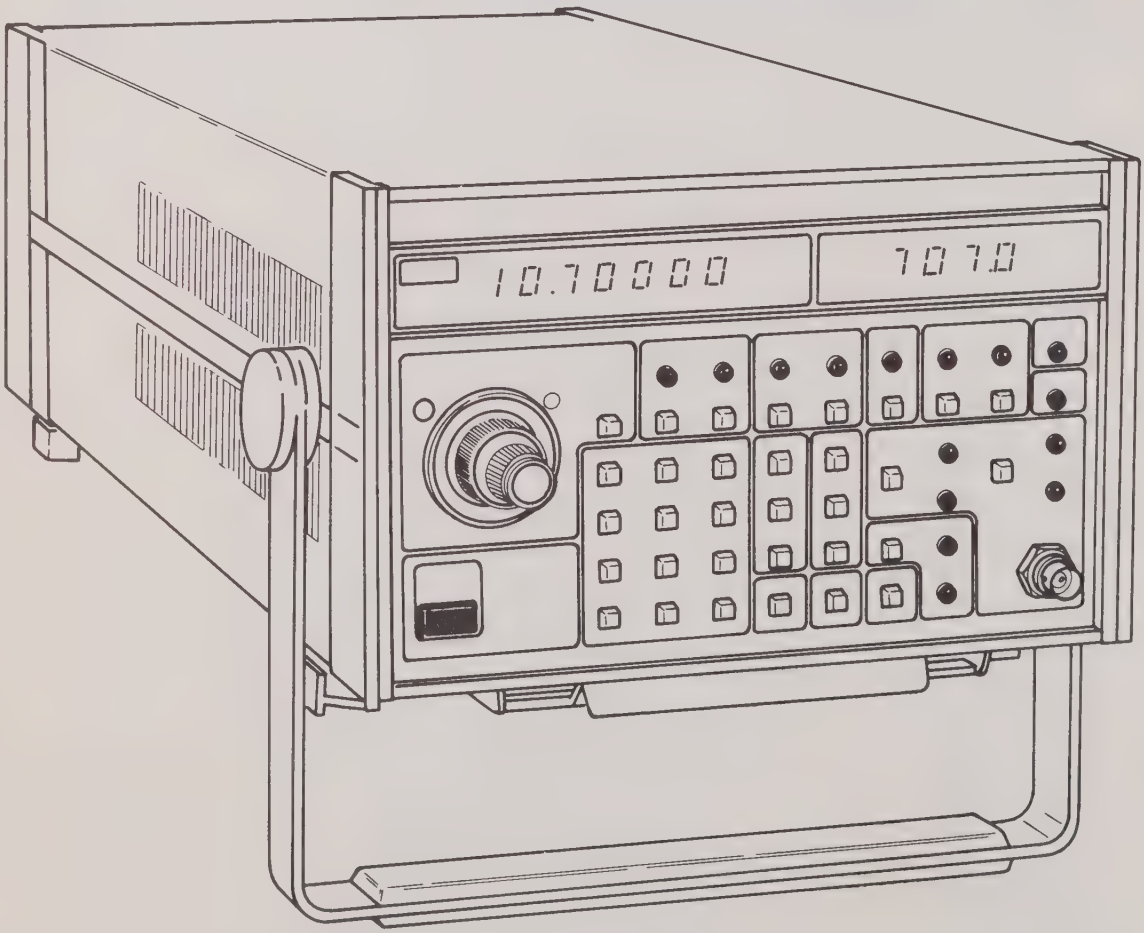


Model 6011A Synthesized Signal Generator

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 6011A Synthesized Signal Generator provides keyboard control of output frequency, from 10 Hz to 10.99999 (11) MHz, and output amplitude, from 0.4 mV rms to 5.0 rms into 50 ohms. The frequency band is covered in two overlapping ranges. The low range, spanning 10 Hz to 109.9999 (110) kHz, provides frequency resolution of 0.1 Hz while the high range provides 10 Hz resolution for output frequencies from 110 kHz to 11 MHz. The range is automatically selected to provide maximum resolution for the selected output frequency. The instrument can be manually placed in either high or low range (below 110 kHz) using the range override control.

1-3. The signal output level can be selected in volts, millivolts or decibels. The volts or millivolts output can be expressed in either V p-p or V rms. Output signal level as well as frequency are displayed on the front panel. An edit control allows any displayed digit, either in frequency or amplitude, to be selected (indicated by the brightened digit) and changed.

1-4. Keyboard information for up to nine separate signal generator output conditions can be stored, then recalled to provide the preselected output. The microprocessor stores these sets of output conditions in its internal memory. Settings can be recalled in any order by pressing the appropriate button.

1-5. A reference frequency and reference level can be selected around which the output of the generator can be varied. A change sign key (+/–) determines whether the next frequency or level command will be added to or subtracted from the references. The actual value of frequency and level at the generator output, i.e., the reference frequency and level plus the deviations, can be displayed on the front panel by pressing the "ACTUAL" key.

1-6. Modulation of the generator output signal, in either amplitude or frequency (optional), can be selected by keys on the front panel. Rear panel input jacks provide for external voltage control of up to 90% amplitude modulation and +/– 20 kHz frequency deviation. An amplitude Level Limit can be stored in memory. This feature prevents an operator from inadvertently programming levels greater than the pre-stored limit.

1-7. Optional features and Accessories are available to tailor the signal generator to specific applications. These options and accessories are described in Table 1-1.

1-8. SPECIFICATIONS

1-9. The pertinent specifications for the Model 6011A and options are listed in Table 1-2.

Table 1-1. Options and Accessories

OPTION/ ACCESSORY	DESCRIPTION
–01	High Performance TCXO
–02	Phase Lockable Input
–03	Frequency Modulation (FM)
–04	Rear Panel (RF) Output
–05	IEEE Standard 488-1975 General Purpose Bus Interface
–06	EIA Standard RS-232-C Interface
–07	50 to 400 Hz line power
–08	100V, 50 to 60 Hz line power
–09	20-31 MHz Tracking Output
–10	75 Ohm Output Impedance
M05-203-601	Left or Right Offset Rack Mounting Kit
M05-203-602	Center Rack Mounting Kit for one instrument
M05-200-603	Dual side-by-side Rack Mounting Kit
M00-260-610	18 inch chassis slides for use with dual side-by-side Rack Mounting Kit
M00-203-631	Left or Right Offset Rack Mounting Kit including 18 inch chassis slides
6010-A-7001K	6010A/6011A Service Kit

Table 1-2. 6011A Specifications

FREQUENCY

Ranges:	10 Hz to 10.99999 MHz in the high range. 10 Hz to 109.9999 kHz in the low range.
Resolution:	10 Hz in the high range. 0.1 Hz in the low range.
Range Selection:	Automatic with manual override.
Standard TCXO	
Accuracy:	±3 parts in 10^6 per year over temperature range of 0° to 50°C.
Aging Rate:	Less than 1 part 10^8 per day at constant temperature or 1 part in 10^6 per year.
Temperature Dependence:	Less than ±2 parts in 10^6 from 0° to 50°C (±5 parts in 10^7 with Option −01).
Local Control:	Keyboard selection of numeric data, units indicator (Hz, kHz, MHz) modulation (AM or optional FM), and Frequency Edit.
Remote Control:	Character serial ASCII Data Format-Two programming formats fixed form and free form.
Display:	Seven digit LED Display.
Storage:	Facility to store and recall 9 front panel settings including frequency, output level, and modulation settings.
Switching and Settling:	Low Range: After update, frequency settles to within 10 Hz of final frequency in less than 2 mS in fixed form programming and in less than 34 mS in free form. High Range: After update, frequency settles to within 1 Hz of final frequency in less than 2 mS in fixed form and in less than 34 mS in free form. Range Change: Frequency settles within specifications in less than 10 mS in fixed form.

SPECTRAL PURITY

Harmonics:	High Range: −30 dB from 10 Hz to 100 Hz −50 dB from 100 Hz to 1 MHz −40 dB from 1 MHz to 11 MHz (Except −35 dB for output levels within 2 dB of maximum output from 5 MHz to 11 MHz).
Total Harmonic Distortion (100 Hz to 110 kHz):	Low Range: < 0.15% (Typically .07%) High Range: < 0.3% (Typically 0.1%)
Spurious:	All nonharmonically related outputs will be greater than 60 dB below the specified output or −110 dBm whichever is greater.
Signal to Phase Noise Ratio:	Greater than 46 dB as measured in a 30 kHz band excluding 1 Hz centered on the carrier, including the effects of the internal standard. Residual (excluding internal standard) is greater than 50 dB. Improvement on Low Range.
Phase Noise Spectral Density:	SSB S/N ratio at the output measured in a 1 Hz bandwidth at maximum output (typical). Improvement on Low Range 10 dB.

OFFSET FREQUENCY	SSB S/N
20 Hz	102 dB
200 Hz	108 dB
20 kHz	106 dB
1 MHz	130 dB

Table 1-2. 6011A Specifications (cont)

OUTPUT AMPLITUDE	
Amplitude (Maximum):	5.000V rms terminated into 50 ohm 10.000V rms open circuit 14.14V p-p terminated into 50 ohm 28.28V p-p open circuit +26.98 dBm 50 ohm Reference.
Amplitude Range	
dBm:	+26.98 dBm to –55.01 dBm 50 ohm Reference
volts:	5.000V to 0.3972 mV into 50 ohm
Amplitude Resolution	
dB:	0.01 dB
volts:	1V to 5.000V 1 mV 100 mV to 999.9 mV 0.1 mV 10 mV to 99.99 mV 10 μV 1 mV to 9.999 mV 1 μV 0.3972 mV to 0.9999 mV 0.1 μV
Output Impedance:	50 ohms
Amplitude Accuracy:	See Figure 1-1.
Amplitude Temperature Stability:	±0.2 dB, 0°C to 50°C. Typical temperature coefficient is .003 dB/°C, 20° to 30°C.
Frequency Response:	See Figure 1-2.
Amplitude Switching and Settling Time	±1 dB, 150 mS, fixed form ±0.1 dB, 300 mS, fixed form ±0.01 dB, 450 mS, fixed form (Add 200 mS for free form)
Display	
dB:	4 digits plus sign in dBm or dB with respect to a stored reference.
volts:	4 digits in V p-p or V rms; Open circuit or Terminated or volts or dB with respect to voltage reference.
AM Modulation:	Analog input can be used to provide amplitude modulation. Bandwidth of this input is dc to 10 kHz and maximum modulation is 90%. Zin = 600 ohms, ±4V corresponds to 100% modulation.
Remote Control:	Character serial ASCII data format. Two programming formats-fixed form and free form.
AUXILIARY OUTPUTS	
TTL Output:	TTL compatible square wave output (< .5V to > 2.4V p-p into 50 ohms) at the synthesized output frequency.
Reference:	Derived from the synthesizer frequency reference. 1 MHz is standard; 5 or 10 MHz available by changing internal jumper. Output is TTL compatible square wave.
INPUTS	
External Reference:	Requires a 10 MHz TTL compatible square wave with symmetry between 40 % and 60% (100 mV to 5V rms into 50 ohms if –02 Option installed). Internal reference automatically selected in the absence of an external reference.

Table 1-2. 6011A Specifications (cont)

GENERAL	
Operating Environment:	0-50°C, 0-80% RH, 0-10,000 feet.
Non-operating:	−40° to +75°C.
Line Power:	115/230V rms ±10%, 48-62 Hz, 100W. 100V rms ±10%, 48-62 Hz (optional). 115/230V rms ±10%, 50-400 Hz (optional).
Size:	13.34 cm X 21.59 cm X 48.26 cm (5¼" H X 8½" W X 19" D)
Weight:	11.4 kg (25 lbs)

OPTION SPECIFICATIONS		
Option −01		
High Performance TCXO:		
Frequency Accuracy:	±1.5 parts in 10^6 for one year over the temperature range of 0°C to +50°C.	
Aging Rate:	< 1 part in 10^8 per 24 hours at constant temperature, or 1 part in 10^6 per year.	
Temperature Dependence:	< ±5 parts in 10^7 from 0° to 50°C.	
Option −02		
Phase Lockable Input:		
Input Frequency:	1, 2, 2.5, 5 or 10 MHz.	
Input Level:	> 100 mV, < 5V rms into 50 ohms. May be used with either the standard oscillator or the optional high performance TCXO.	
Locking Range:	±5 parts in 10^6 from frequency of internal oscillator.	
Option −03		
Frequency Modulation:	High Range	Low Range
Deviation about dialed frequency:	±20 kHz	±200 Hz
Accuracy 0-50°C:	±1.5 kHz	±15 Hz
Rate:	dc to 10 kHz	dc to 10 kHz
Linearity at constant temperature:	±1 kHz	±10 Hz
Stability at constant temperature:	±400 Hz	±4 Hz
Incidental AM (typical)	< 1%	< .5%
Impedance:	600 ohms	600 ohms
Input Sensitivity:	1V for 4 kHz ±5V max.	1V for 40 Hz ±5V max.
Distortion:	Typical distortion < 2% at 6V p-p, 2 kHz. Improves at lower input levels.	
Option −04		
Rear Panel (RF) Output:	10 Hz to 11 MHz.	

Table 1-2. 6011A Specifications (cont)

OPTION SPECIFICATIONS (cont)	
Option –05	
IEEE Standard 488-1975 General Purpose Bus Interface	
Option –06	
EIA Standard RS-232-C Interface	
Option –07	50 Hz to 400 Hz line power.
Option –08	100V ±10%, 48 to 62 Hz line power.
Option –09	
20-31 MHz Tracking Output	TTL level signal at a frequency of 20 to 31 MHz, rear panel BNC. Frequency is 20 MHz higher than main RF output in high range.
Option –10	
75 ohm OUTPUT IMPEDANCE	
Amplitude Range	
dBm:	+25.22 to –56.76 dBm into 75 ohm.
volts:	5.000 to 0.3972 mV into 75 ohm.
Amplitude Accuracy:	Same as 50 ohms (see Figure 1-1).
Frequency Response:	See Figure 610-1.

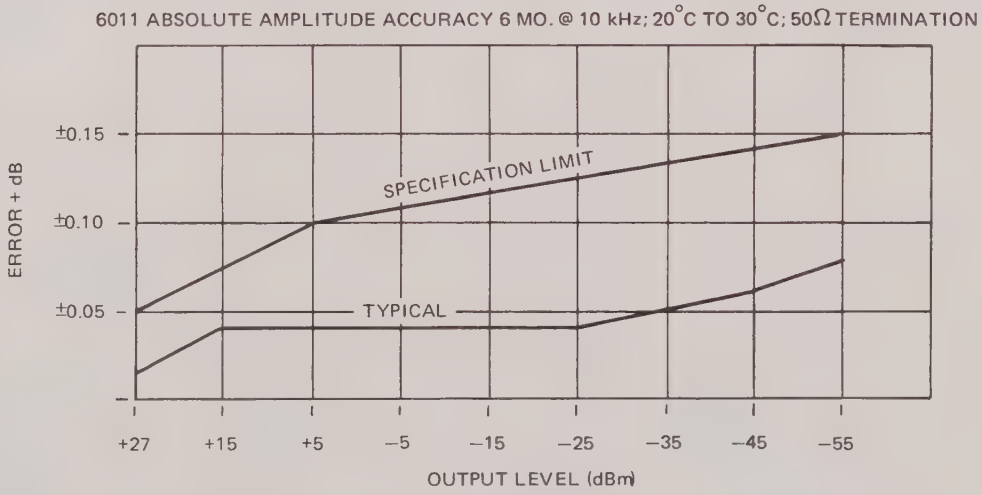


Figure 1-1. Amplitude Accuracy Graph (50Ω Term)

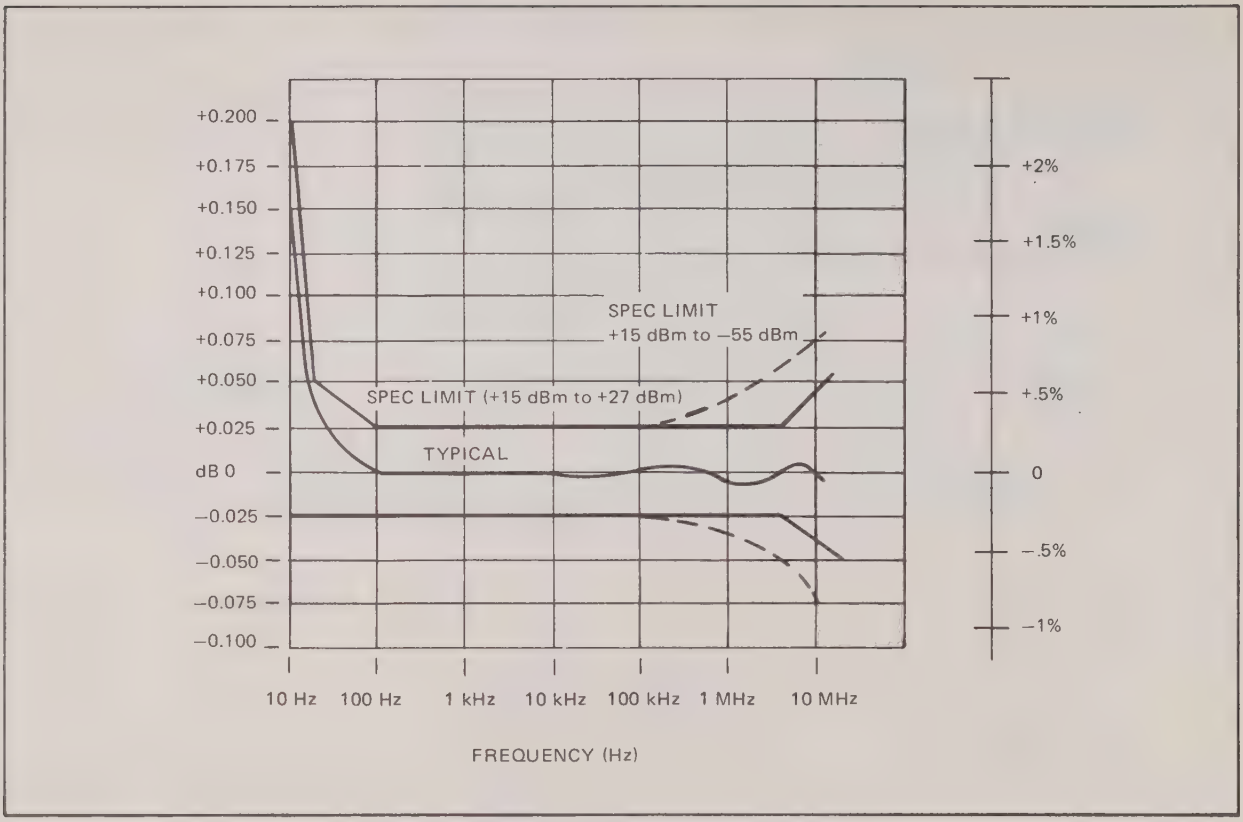
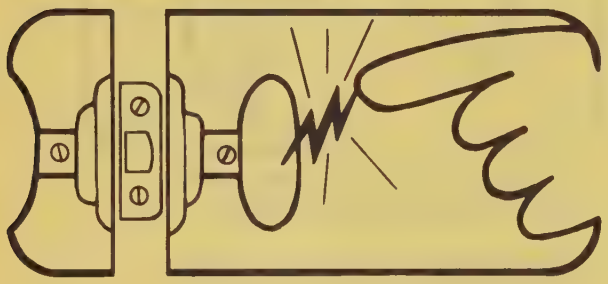


Figure 1-2. Frequency Response 50Ω Termination Graph

static awareness

A Message From

John Fluke Mfg. Co., Inc.

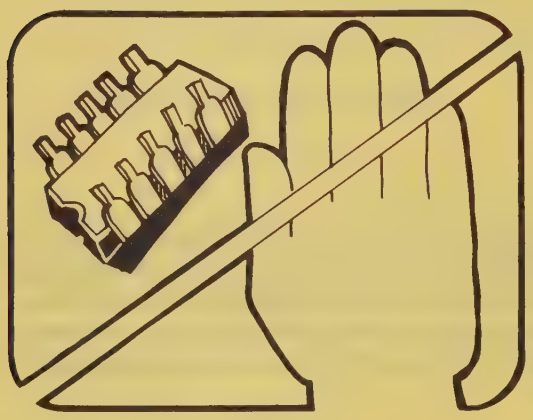


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

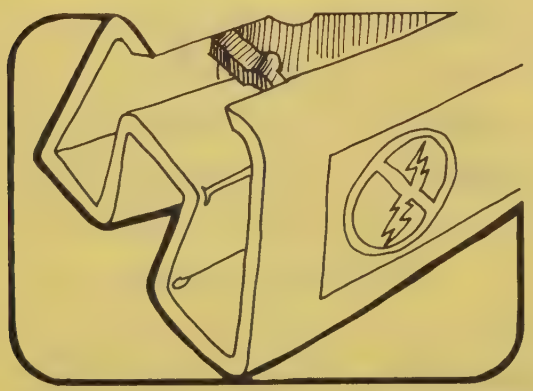
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗".

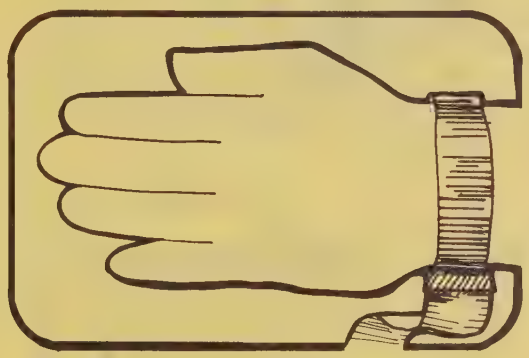
The following practices should be followed to minimize damage to S.S. devices.



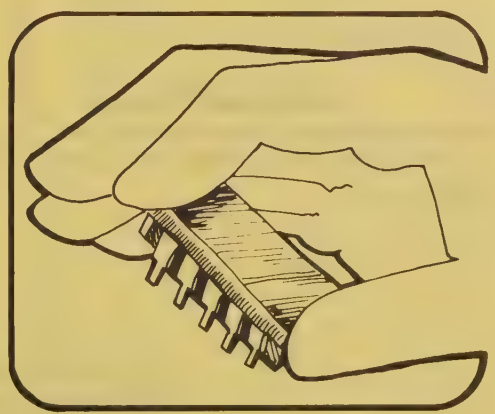
1. MINIMIZE HANDLING



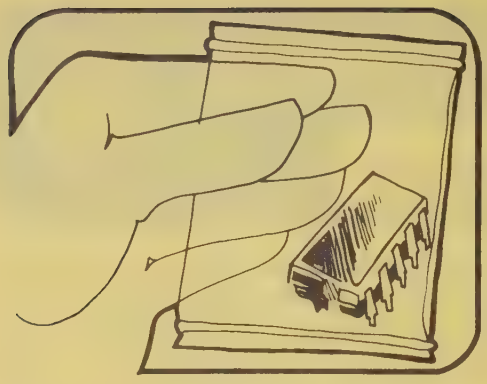
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



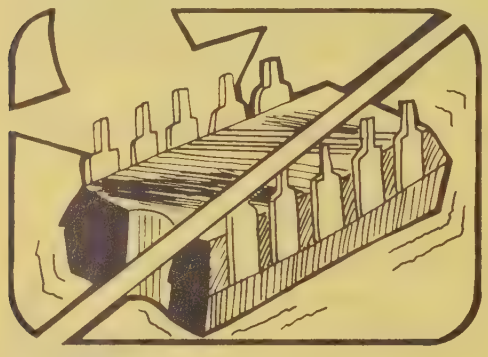
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



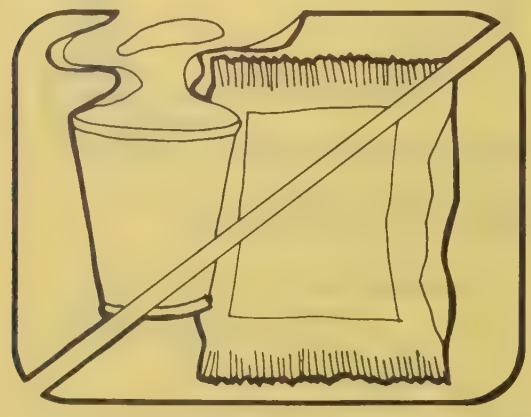
4. HANDLE S.S. DEVICES BY THE BODY



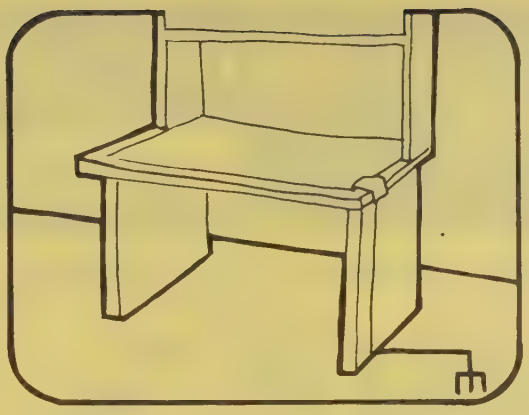
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

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Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains information essential for correct operation of the Model 6011A. Should any difficulties be encountered during operation, please contact the nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc. A list of Sales Representatives is located at the rear of this manual.

2-3. SHIPPING INFORMATION

2-4. The 6011A is packaged and shipped in a foam packed cardboard carton. Upon receipt, a thorough inspection of the instrument should be performed to reveal any damage that may have occurred in transit. If reshipment is necessary, the original container should be used. If it is not available, a new container can be obtained from the John Fluke Mfg., Co., Inc. Please reference the instrument model number when ordering a new container.

2-5. INPUT POWER

2-6. The 6011A can be operated from either 115 OR 230V AC +/-10%, 48 to 62 Hz line power. A slide switch located in the bottom of the Main PCB (refer to Section 4 for access information) can be positioned to allow operation from the appropriate line voltage. The line power fuse (F1) is located in a fuse holder on the rear panel. Correct fuse size for 115 Volt and 230 Volt operation is provided next to the fuseholder.

2-7. OPERATING FEATURES

2-8. The location of all controls, connectors, and indicators is shown in Figure 2-1. The function of the groups of controls identified in Figure 2-1 is explained in Table 2-1. More detailed operating information is provided in this section under General Operating Information.

2-9. GENERAL OPERATING INFORMATION

2-10. The following information is designed to acquaint the operator with the proper sequence of control manipulations required to obtain specified signal generator outputs. It is recommended that the operator perform the following procedures in order to familiarize himself with the functional capabilities of the 6011A signal generator. The signal generator output can be connected to an oscilloscope which is terminated in 50Ω so that the output signal can be observed.

2-11. Power On

2-12. The 6011A is designed to provide maximum attenuation and zero output frequency when the front panel POWER button is pressed to the ON position. Observe the front panel for the following indication when the power is first applied to the unit.

1. The most significant frequency digit (left) should be zero; all others blank.

2. The OUTPUT, TERM (terminated) and V rms indicators are on.

2-13. Output Frequency Selection

2-14. The following procedure provides examples illustrating the front panel keyboard entry for selection of output frequencies. Digit keys 0 through 9 plus the decimal point key are used to sequentially enter the desired output frequency: starting with the most significant digit. When the frequency unit key (Hz, kHz or MHz) is pressed, the selected output will be displayed in the left portion of the front panel. If the selected frequency is 109.9999 kHz or less the LOW range indicator will light. If the frequency is between 110 kHz and 10.99999 MHz the HI range indicator will light.

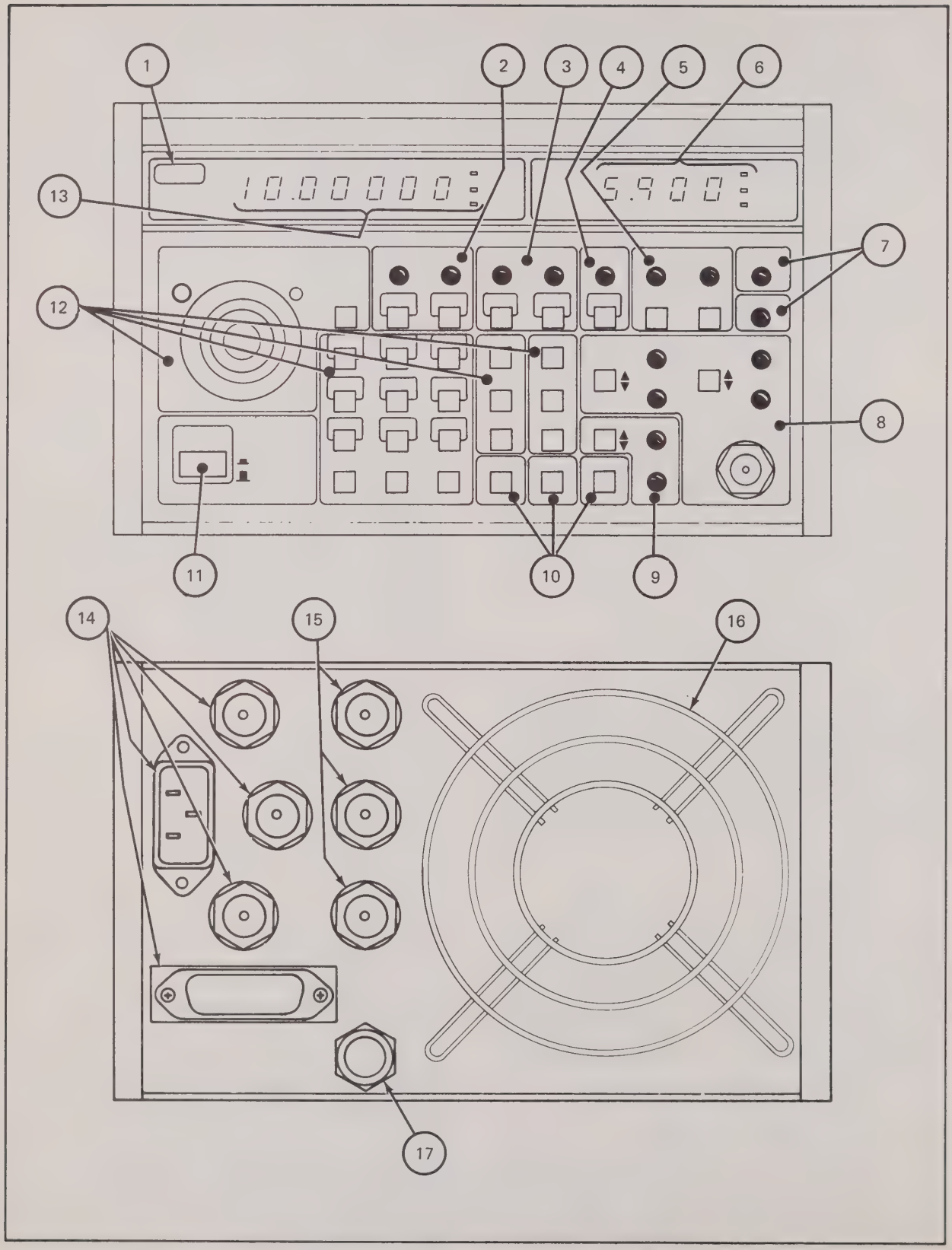


Figure 2-1. 6011A Controls, Connectors and Indicators

Table 2-1. Operating Controls Functional Description

REF. NO.	NAME	FUNCTIONS
1	DISPLAY OVERFLOW	Lights when an illegal frequency is programmed, i.e., frequencies greater than those that can be displayed.
2	REFERENCE FREQ. CONTROLS	This key is used in conjunction with memory STORE key to store a reference frequency. LEVEL: This key is used in conjunction with the memory STORE key to store a reference level. To recall a reference, press RECALL and REFERENCE FREQ or LEVEL. To restore normal operation, press LAST.
3	MEMORY	STORE: The controller stores up to nine combinations of output settings, a reference frequency, a reference level, or a level limit in its internal memory. RECALL: Settings can be recalled in any order at the press of the appropriate button. *NOTE* *The recalled display may not indicate the actual output of the 6011A, i.e., if a reference frequency or reference level is stored and a digit (1-9) storage location is recalled, the display will indicate the data in the storage location but the 6011A output will be a sum of the reference (frequency and/or level) and the data stored at a particular memory location (1-9).*
4	LEVEL LIMIT CONTROL	A level limit, less than 5V rms maximum output, can be selected to prevent inadvertent selection of potentially damaging output levels. Set the desired level, press the STORE key, then the Level LIMIT key. The level limit light on indicates that a limit $<$ 5V rms into 50 ohms has been stored. The current value of the level limit can be observed by pressing RECALL LEVEL LIMIT to restore normal operation press LAST.
5	OUTPUT SIGNAL MODULATION	AM: Amplitude Modulation of the output signal is selected by pressing the Modulation AM key. The amount of modulation is controlled by an analog voltage applied to the AM IN rear panel connector. FM: Frequency Modulation is selected by pressing the MODULATION-FM key. The amount of modulation is controlled by the amount of voltage applied to the VCXO via input unity gain buffer amplifier. (FM option must be installed.)
6	OUTPUT LEVEL DISPLAY	The selected output level will be displayed when the output level and unit (V, mV, dB) is selected.
7	STATUS INDICATORS	REMOTE: The remote indicator lights when the 6011A is being remotely controlled. REDUCE LEVEL: The reduce level indicator lights when a selected AM external signal attempts to produce a peak level greater than 5V rms. Reducing modulating signal level or output level such that the peak of the modulated signal is less than 5V rms, will return the instrument to normal operation.

Table 2-1. Operating Controls Functional Description (cont)

REF. NO.	NAME	FUNCTIONS
8	OUTPUT CONNECTORS AND CONTROLS	The BNC connector provides front panel output of the selected frequency and level. OPEN-TERM Control: Selects the appropriate Scaling Factor dealing with a specific output level configuration; i.e., the Voltage that will be developed across a 50 ohm load (5V rms max) or the Voltage being developed across an open circuit (10V rms max). V p-p - V rms: Allows for selection of output level Scaling Factor in either peak-to-peak voltage or rms voltage. *NOTE* *Output level display will not be affected by the Scaling Factor.* *NOTE* *OUTPUT annunciators are the only indicator available to the operator for determining which type Scaling Factor is in effect.*
9	MANUAL RANGE CONTROL	RANGE OVERRIDE: Causes a low range (.1 Hz resolution) output frequency to change to a high range (10 Hz resolution). The control will cause a high range output frequency to change to low range if the output frequency is below 110 kHz.
10	DISPLAY CONTROLS	CE: Clear Entry key will cause the output frequency display to show only a zero in the most significant digit. This key can be used to correct an error in data entry, and exit from the STORE & RECALL modes. ACTUAL: This key will cause the display to indicate the actual instrument output (frequency and level). LAST: This key will cause the display to indicate the last valid entry (frequency and level).
11	POWER	Switch applies line power to the 6011A circuitry.
12	OUTPUT CONTROLS	Keyboard entry for digit, decimal point, and units (MHz, kHz or Hz for output frequency and for digit, decimal point, and units (V, mV or dB for output level).
13	OUTPUT FREQUENCY DISPLAY	Each digit of new entry, either frequency or level, will appear in this display as it is selected. If the entry is for an output level, the display will shift to the Output Level display when a level unit's key is pressed. If the entry is frequency, then the Output Frequency display will indicate the selected frequency when (MHz, kHz, or Hz) key is pressed.
14	INPUTS	FM IN (optional): Used to control frequency modulation of the 6011A output signal. AM IN: Used to control amplitude modulation of the 6011A output signal. EXT REF: Provides connection for a 10 MHz TTL compatible square wave input to be used as the 6011A reference signal or a 1, 2, 2.5, 5 or 10 MHz sine wave with –02 (Phase Lock Input) Option. REMOTE CONTROL: A 24-pin connector for ASCII format remote control inputs. All control functions selectable by the front panel keyboard can be remotely programmed except the POWER, LAST, ACTUAL, OPEN/TERM and V p-p/V rms controls. Three prong AC 115/230V connector.

Table 2-1. Operating Controls Functional Description (cont)

REF. NO.	NAME	FUNCTIONS
15	OUTPUTS	SYNTH OUT (optional): Replaces the front panel OUTPUT connector to allow rear panel connection for the 6011A outputs. May be used for other option outputs. TTL OUT: Provides a TTL compatible output signal equal in frequency to the generator output signal. REF OUT: Provides a 1, 5, 10 MHz (selected by internal jumpers) TTL compatible output derived from the reference oscillator. (1 MHz Factory Selected.)
16	FAN AND FAN GUARD	
17	FUSE HOLDER	

NOTE

An external instrument will not register a signal until both output frequency and level have been programmed into the 6011A.

Example 1: Desired output frequency 9.8324 MHz

1. Press the digit key 9; note the most significant digit of the display is 9.

2. Press the decimal key; the decimal should appear to the right of the 9.

3. Press the remaining digit keys; i.e., 8, 3, 2 and 4 noting that the digits appear in the display.

4. Press the MHz key. The display should show the digits 9.83240 digits (the zero sould be bright) and the MHz indicator should be lit. The HI range LED should also be energized.

Example 2: Desired Output Frequency 12.384 kHz

1. Press each successive digit key, plus the decimal key, noting the display shows each digit as it is pressed.

2. Press the "kHz" key. The display should show the digits 12.3840 and the "kHz" indicator should be lit. The LO range LED should also be energized.

2-15. Output Level Selection

2-16. After selecting the output frequency, the desired output levels should be entered. Digit keys 0 through 9 plus the decimal point key enter the numeric value followed by the output level units (V, mV, or dB). In the following examples note that the digits being entered appear at the left of the front panel display, then transfer to the right when the level unit key (V, mV or dB) is pressed.

Example 1: Desired output level 2.186 volts

1. Press the digit key 2; note the displayed frequency is replaced by a two in the most significant digit.

2. Press the decimal point key; the decimal point should appear to the right of the 2.

3. Press the 1, 8 and 6 digit keys successively noting that each appears in the display.

4. Press the volts (V) key; note the output level indications shifts to the right of the display and the selected output frequency is displayed on the left.

Example 2: Desired output –24.69 dBm

1. Press the +/– key; a minus sign should appear at the left of the frequency display.

2. Press the 2 digit key; note that a two appears.

3 Press the 4, decimal, 6, and 9 keys.

4. Press the dB level unit key; the output level indication shifts to the right display and the selected output frequency returns to the left display.

NOTE

The output level is in dBm when a REFERENCE LEVEL has not been entered or when the REFERENCE LEVEL is entered as a dB value. When the REFERENCE LEVEL is entered as a V or mV value, followed by level entries in dB, the actual 6011A output level is in V or mV.

2-17. Invalid Input Indication

2-18. Selected inputs, either frequency or level, which exceed the limitation of the generator or exceed the stored level limit will cause the digits of the corresponding display to flash. Further programming cannot be accomplished until the invalid entry is corrected. The invalid input indication can be observed by selecting an output frequency of 11 MHz or selecting an output level of zero volts.

2-19. Display Overflow

2-20. The DISPLAY OVERFLOW indicator lights when an excessively large frequency is entered on the front panel controls, such as 111.11 MHz. There will be no output at the front panel BNC connector when the overflow indicator is on. Normal operation can be resumed by keying a valid frequency.

2-21. Edit Control

2-22. The edit control allows a valid output frequency or output level to be adjusted without re-entering a new input. When an output frequency is entered the least significant digit of the displayed frequency will be brighter than the other digits. (The bright digit will shift to the least significant position of the level display when a level is entered.) The DECADE portion of the edit control changes the position of the bright digit. The DIGIT portion of the control will increment or decrement the value of the bright digit.

NOTE

The Edit Decade Control will erase numerical entries in the left hand display before a unit's key is pressed. One decade entry is removed for each detent position when rotated CCW.

NOTE

The digit control will carry over to more significant decades but will not affect less significant decades.

2-23. Step Size

2-24. Step size is a selected value from 1 through 9. When using the Digit switch you can select the size of its increment or decrement by pressing STEP SIZE and the desired number.

2-25. Storing and Recalling Selected Outputs

2-26. The 6011A is capable of storing control data for up to nine different signal generator outputs. The stored data includes frequency, output level, output terminal conditions (terminated or open, V p-p or V rms), range override, and signal modulation. Once stored, the control data can be recalled to produce the pre-selected generator output. The generator operation for storage and recall is described in the following procedure:

1. Select an output frequency and output level.

2. Press the memory STORE key, noting that the store indicator comes on.

3. Press any digit key (1 through 9) to select a storage location for the data. (The store indicator should go out.)

4. Select a new output frequency and output level.

5. Press the memory STORE key then a different digit key to select a new storage location.

6. Press the memory RECALL key, then the digit key selected in step (3). The generator output should be equal to that selected in step (1). Note the RECALL light remains on during each recall operation.

NOTE

Editing will not affect stored data while in the RECALL mode.

7. Press the RECALL key to exit the RECALL mode.

2-27. Amplitude Modulation of the Output Signal

2-28. An analog input signal to the AM IN connector on the rear panel provides amplitude modulation control of the 6011A output when the modulation AM key is selected. The frequency of the modulation signal determines the rate of modulation. The modulation signal level regulates the percentage of modulation of the 6011A output.

2-29. The degree to which a 6011A output will be modulated by an AM IN signal depends upon the peak-to-peak amplitude and frequency of the modulation signal. Figure 2-2 illustrates the relationship of the AM IN signal (dc and ac, 10 Hz to 10 kHz) to the percent of modulation.

2-30. Since the 6011A level is limited to a value of approximately 5V (rms), the peak value of the modulated signal must be less than 7 volts. Exceeding this value will cause the REDUCE LEVEL light to come on. The following formula can be used to determine whether a

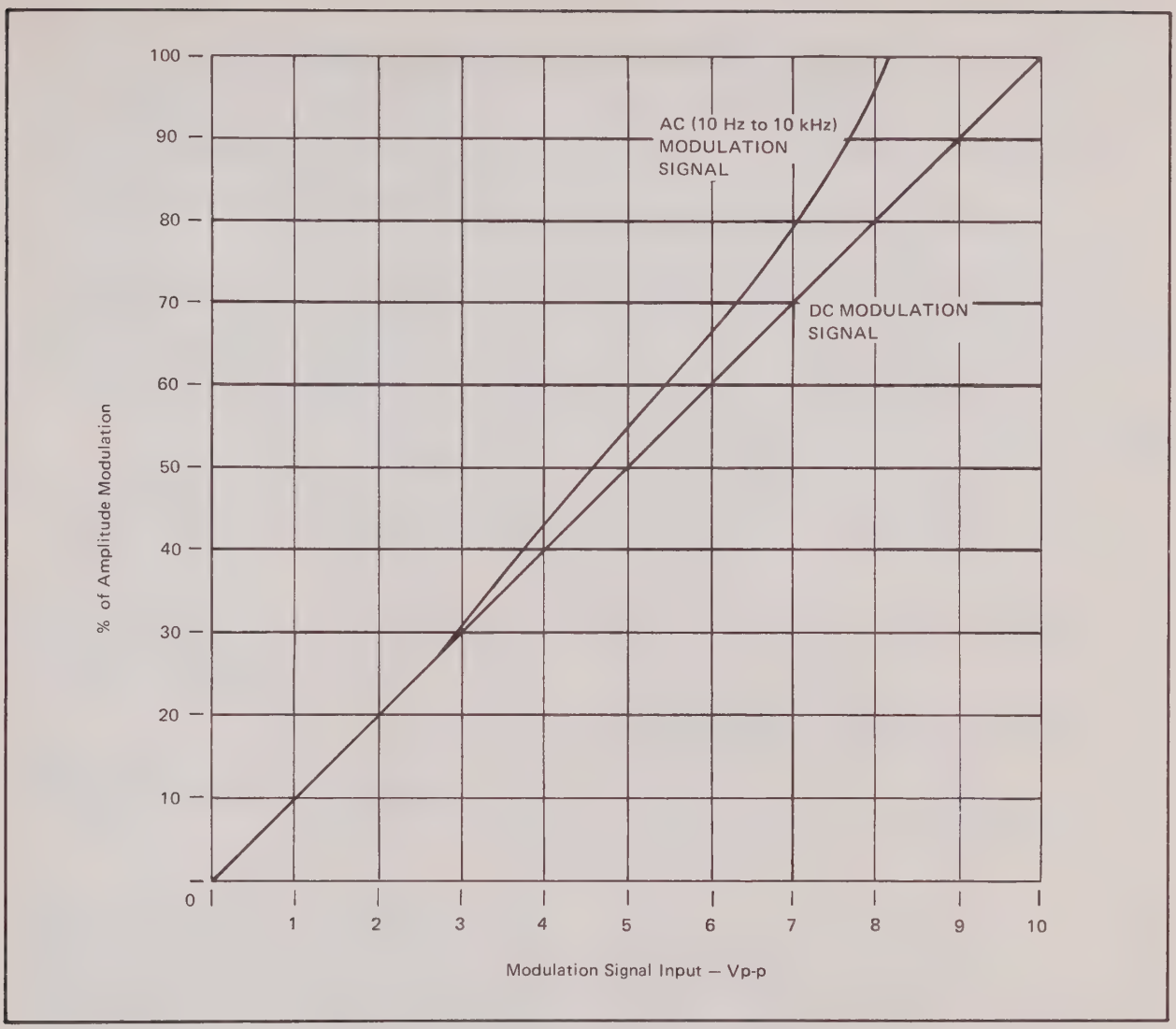


Figure 2-2. Amplitude Modulation Characteristics

particular AM input and selected output level will exceed the output limit.

$$\frac{V_{AMIN}}{8} \times V_{OL} + V_{OL} \leqslant 5V \text{ rms}$$

Where V_{AMIN} is equal to the peak value of the input applied to the AM IN connector and VOL is equal to the output level selected.

2-31. Setting a Reference Level and Frequency

2-32. A reference frequency and/or reference level can be entered into the 6011A around which the output signal can be varied. For instance, when a reference frequency is entered, frequencies subsequently selected will be added to or subtracted from that reference frequency. The following procedure will exercise the 6011A in this mode:

1. Select a 6011A output frequency of 500 kHz and output level of 2.5 volts.

2. Press the memory STORE key then the REFERENCE FREQ key.

3. Press the memory STORE key, then the REFERENCE LEVEL key.

4. Select an output frequency of 10 kHz. The display should show 10 kHz only.

5. Press the ACTUAL key. The display now indicates the acutal output of the 6011A (510.00 kHz at 2.500V). The flashing decimal points in both

frequency and level display are an indication that the display is of the actual output.

6. Press the LAST key. The display will show the last valid selection made (10 kHz).

7. Press the memory RECALL key, then the REFERENCE FREQ key. This display will show the value of the selected reference frequency with the decimal points in the frequency display flashing.

2-33. Output Level Limit

2-34. An output level limit can be selected above which the output level cannot be programmed. The following procedure illustrates how an output level limit is selected.

1. Select an output frequency of 10 kHz and an output level of 2.0 volts.

2. Press the memory STORE key, then the level LIMIT key. The 6011A is limited to a maximum output level of 2 volts.

3. Select an output level of 2.5 volts. The display will flash an output level of 2.5 volts but the output will remain at the last correct programmed level.

4. Press the LIMIT key to exit the level limit mode of operation.

2-35. Output Terminal Controls

2-36. Two keys provide selection of volts peak-to-peak or volts rms signal output and selection of either terminated (50 ohm) or open circuit output connector loading. Pressing the single key provided for each output operation toggles the output conditions between (OPEN) and (TERM) output terminal loading in one case and between (Vp-p) and (V rms) output level in the other.

2-37. REMOTE CONTROL OPERATION OF THE MODEL 6011A

2-38. Introduction

2-39. The 6011A Synthesized Signal Generator can be programmed using either of two formats (or instruction sets) and either of three interfaces: standard, IEEE-488 or RS-232C. The standard 6011A is equipped with a Fluke defined interface consisting of a two-wire handshake with seven ASCII defined data lines. Data is transferred into the 6011A is seven bit bytes, i.e., character serial.

1. Option -05 is the IEEE standard digital interface for instrumentation. This interface is defined in IEEE STD 488-1975.

2. Option -06 is the RS-232C bit serial interface and is defined in EIA publication RS-232C.

3. These interfaces are mutually exclusive, that is, only one may be installed in a given instrument.

4. For programming with the options refer to Section 6 of this manual.

2-40. Standard Interface (Fluke-defined)

2-41. This interface uses seven parallel ASCII defined data lines controlled by two handshake lines. ASCII data bit 8 (or parity bit) is ignored. ADB1 is least significant bit, ADB7 is most significant.

2-42. Logic family is TTL. A true condition (or 1) is indicated by a voltage level from +2.4 VDC to +5 VDC. A not-true condition (or 0) is indicated by a voltage from 0 to +0.8 VDC.

2-43. The remote control inputs and outputs are transmitted through the 24-pin connector J4, REMOTE CONTROL. Table 2-2 lists the data terms, a functional description of each, and differentiates between inputs and outputs for each pin of J4.

2-44. The seven bit ASCII code is on pins 1 through 4 and 13 through 15. For decoding, refer to the appropriate program format description.

2-45. Timing of data transfer is controlled by the DRY (Data Ready) input on pin 6, the BSY (Busy) output on pin 7, and the PRD (Processor Done strobe) output on pin 8. Figure 2-3, Model 6011A Data Transfer Command Timing Diagram, provides graphic illustration of the data transfer timing sequence. When the data at the remote connector is to be read, the remote programming unit raises the DRY line high for a period of a least one microsecond. At the time the DRY line goes high, the Model 6011A will raise the BSY line high and latch it high until the data "A" has been read. At that time, data "A": is still being process in the Model 6011A but BSY goes low so there may be another data word, data "B", transmitted from the remote unit. The BSY line will go high. If data "B" is transmitted while the Model 6011A is still processing data "A", BSY will remain high through the processing of data "A": and the reading of data "B". After the data is processed inside the Model 6011A, the PRD line goes low for approximately 1 microsecond.

2-46. Equipment status is flagged by the remainder of the control signals. POWER ON on pin 5 is +5V if the Model 6011A is on, low if the Model 6011A is off. ROL (Reduced Output Level) on pin 11 goes high to indicate that the positive peaks of the modulated signal are

Table 2-2. Remote Control Connections for Standard Interface

PIN NO.	FUNCTION	INPUT OR OUTPUT	DESCRIPTION
1	ADB1	In	Four of eight ASCII Data Bit Input lines
2	ADB2	In	
3	ADB3	In	
4	ADB4	In	
5	POWER ON	Out	+5 volt indicates 6011A power is on. Low indicates power off.
6	DRY	In	Data Ready: positive edge indicates that the input data is ready for transfer. Must stay high for at least 1 μsec.
7	BSY	Out	Busy indication: high true indication that the 6011A is busy reading the input data. *NOTE* *The input data to the 6011A must be held constant until the BSY line goes low.*
8	PRD	Out	Processor Done Strobe: low = processor done, approximately 1 μsec wide.
9	REM	In	Remote Control order: low true input to order 6011A remote operation. *NOTE* *When 6011A is placed in remote, any character sent within 2 msec, will not be recognized. This can be avoided by sending a dummy character.*
10	SPARE		
11	ROL	Out	Reduce Output Level: high true indication that the 6011A is being amplitude modulated to produce an output beyond the range of the internal circuitry.
12	SPARE		
13	ADB5	In	Four of eight ASCII Data Bit input lines.
14	ADB6	In	
15	ADB7	In	
16	ADB8	In	
17	SPARE		
18	SPARE		
19	RC FORMAT	In	Remote Control Format: fixed form remote control is called when pin 19 is open or high. Free form remote control is called when pin 19 is pulled low. May not be changed while in Remote. Turn off the instrument before changing.
20	DAS	Out	D/A Converter settling: high when output level not settled, approximately 360 msec.
21	SPARE		
22	SPARE		
23	SPARE		
24	GND		Ground: provides a connection to 6011A logic common.

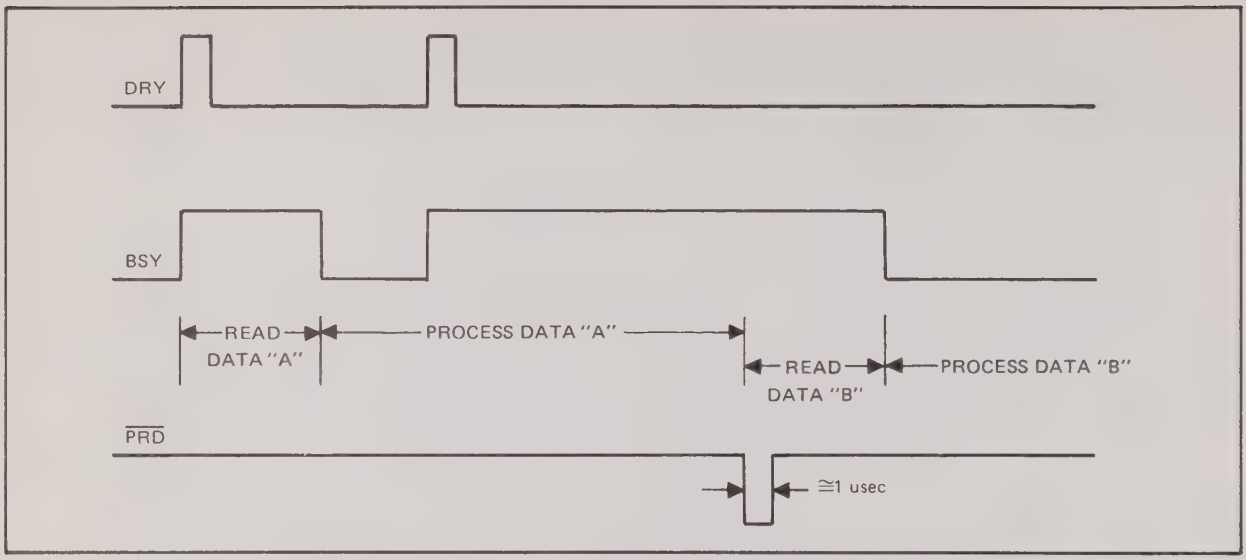


Figure 2-3. Model 6011A Data Transfer Command Timing Diagram

attempting to exceed the maximum allowable output level and have been clipped. The DAS (D/A Settling) signal on pin 20 goes high for 360 milliseconds after a new level command has been processed to allow the D/A converter time to settle. RC FORMAT (Remote Control Format) on pin 19 determines whether the Model 6011A will accept fixed or free remote programming format. More data about RC FORMAT will be presented under the appropriate format discussions.

2-47. Remote Programming the Model 6011A

2-48. PROGRAMMING FORMATS

2-49. The 6011A may be programmed using either of two instruction sets: "fixed" format or "free" format. Fixed format is faster and less flexible than free format. Free format allows digital programming of all front panel functions except the OPEN/TERM, Vp-p/Vrms, Last, Actual and OFF/ON functions. Fixed format allows programming of frequency, range, modulation, and output level in volts behind 50Ω.

2-50. FIXED FORMAT

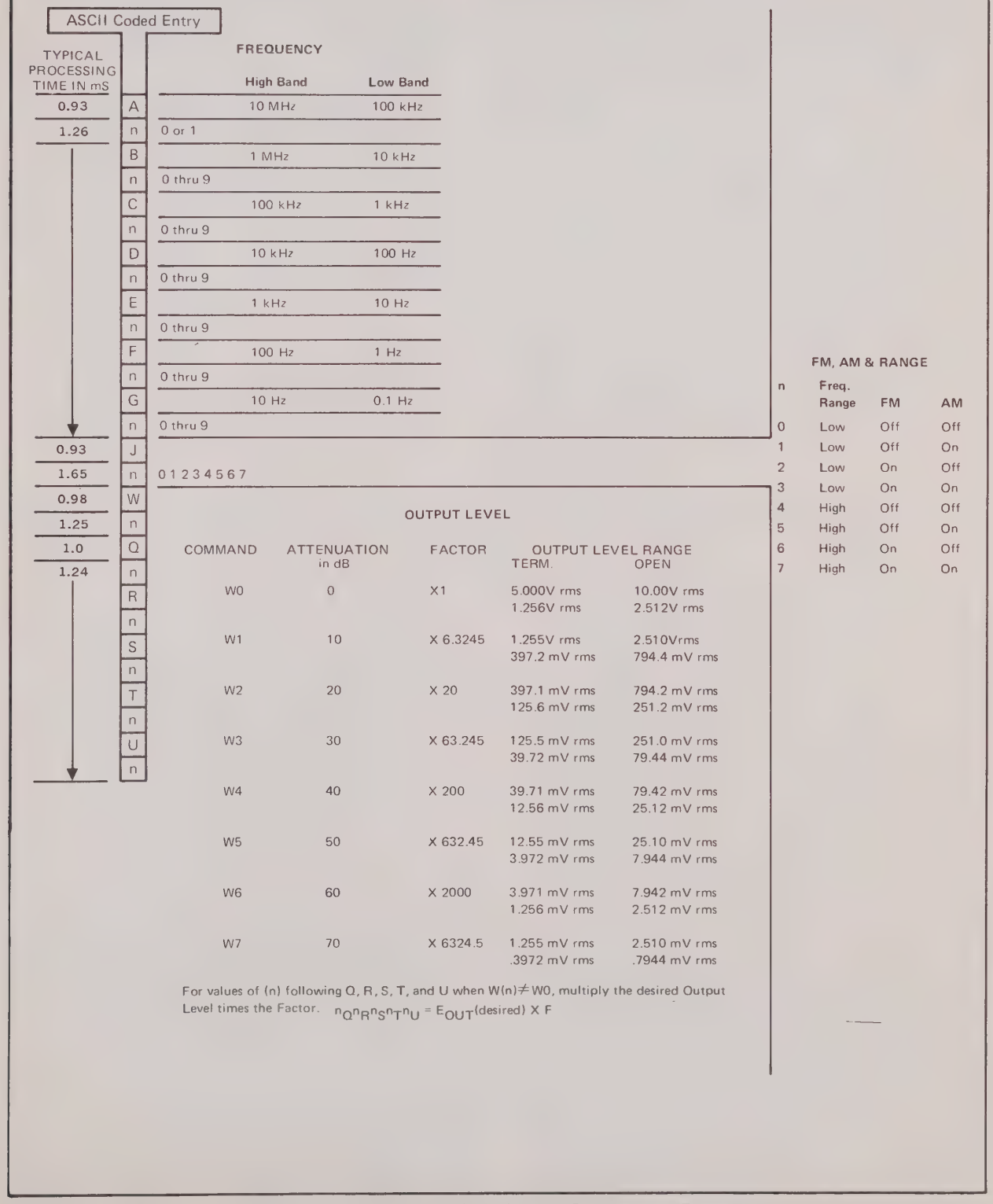
2-51. Fixed format programming allows selection of five instrument parameters: frequency, range (High or Low), FM, AM, and output level. The coding of these parameters forms a word composed of 14 letter-digit pairs. Each letter designates the function of the digit following it. Refer to Figure 2-4, Model 6011A Fixed Remote Programming Format. This figure shows the fixed format word and all necessary coding information. A sample programming problem will be presented at the end of the description.

2-52. To select fixed format over free format, open pin 19 on J4, REMOTE CONTROL connector, on the rear panel. This establishes a permanent high TTL logic level.

2-53. The frequency portion of the fixed format word is composed of seven, letter-digit pairs. Each decade of the output frequency is addressed in a fixed format. The frequency control latches are addressed by ASCII characters "A" through "G" (MSD through LSD respectively). After selecting the significant digit by transmitting the proper letter, the desired digit is transmitted. The frequency word will be either XX.XXXXX MHz or XXX.XXXX kHz depending on Range selected in the next portion of the fixed format word.

2-54. Data in the frequency control latches will remain there until written over or until the power is turned off. Therefore, it is not necessary to re-enter data for digits that are to remain the same in subsequent frequency programming. The output frequency will change as each decimal place is programmed. This makes it possible to scan a range of frequencies, but the function will not be smooth or continuous. For scanning the free remote programming format is highly recommended.

2-55. ASCII character "J" identifies the coded number, 0 through 7, that indicates range selection (High or Low), and whether or not AM and/or FM are enabled. For coding the digit, refer to the table in the "J" coding section of Figure 2-4. Table 2-3 shows the effect on instrument output for various AM and FM inputs.



ASCII Coded Entry

TYPICAL PROCESSING TIME IN mS		FREQUENCY		
		High Band	Low Band	
0.93	A	10 MHz	100 kHz	
1.26	n	0 or 1		
	B	1 MHz	10 kHz	
	n	0 thru 9		
	C	100 kHz	1 kHz	
	n	0 thru 9		
	D	10 kHz	100 Hz	
	n	0 thru 9		
	E	1 kHz	10 Hz	
	n	0 thru 9		
	F	100 Hz	1 Hz	
	n	0 thru 9		
	G	10 Hz	0.1 Hz	
	n	0 thru 9		
0.93	J			
1.65	n	0 1 2 3 4 5 6 7		
0.98	W			
1.25	n			
1.0	Q			
1.24	n			
	R			
	n			
	S			
	n			
	T			
	n			
	U			
	n			

FM, AM & RANGE

n	Freq. Range	FM	AM
0	Low	Off	Off
1	Low	Off	On
2	Low	On	Off
3	Low	On	On
4	High	Off	Off
5	High	Off	On
6	High	On	Off
7	High	On	On

OUTPUT LEVEL

COMMAND	ATTENUATION in dB	FACTOR	OUTPUT LEVEL RANGE TERM.	OPEN
W0	0	X1	5.000V rms 1.256V rms	10.00V rms 2.512V rms
W1	10	X 6.3245	1.255V rms 397.2 mV rms	2.510Vrms 794.4 mV rms
W2	20	X 20	397.1 mV rms 125.6 mV rms	794.2 mV rms 251.2 mV rms
W3	30	X 63.245	125.5 mV rms 39.72 mV rms	251.0 mV rms 79.44 mV rms
W4	40	X 200	39.71 mV rms 12.56 mV rms	79.42 mV rms 25.12 mV rms
W5	50	X 632.45	12.55 mV rms 3.972 mV rms	25.10 mV rms 7.944 mV rms
W6	60	X 2000	3.971 mV rms 1.256 mV rms	7.942 mV rms 2.512 mV rms
W7	70	X 6324.5	1.255 mV rms .3972 mV rms	2.510 mV rms .7944 mV rms

For values of (n) following Q, R, S, T, and U when W(n)≠W0, multiply the desired Output Level times the Factor. $^{n}Q^{n}R^{n}S^{n}T^{n}U = E_{OUT}$(desired) X F

Figure 2-4. Model 6011A Fixed Remote Programming Format

Table 2-3. Model 6011A AM/FM Effects on Outputs

AM		FM	
Instantaneous Modulating Voltage During AM	Resulting Output Voltage rms Terminated, (2.5V rms nominal)	Instantaneous Modulating Voltage During FM	Resulting Nominal Output Frequency Deviation
			HI BAND / LO BAND
> +4.5	Not defined	+5	+20 kHz / +200 Hz
+4.5	4.75	+4.5	+18 kHz / +180 Hz
+3	4.0	+3	+12 kHz / +120 Hz
+2	3.5	+2	+ 8 kHz / + 80 Hz
+1	3.0	+1	+ 4 kHz / + 40 Hz
+0.25	2.625	+0.25	+ 1 kHz / + 10 Hz
0	2.5	0	0 / 0
−0.25	2.375	−0.25	− 1 kHz / − 10 Hz
−1	2.0	−1	− 4 kHz / − 40 Hz
−2	1.5	−2	− 8 kHz / − 80 Hz
−3	1.0	−3	−12 kHz / −120 Hz
−4.5	0.25	−4.5	−18 kHz / −180 Hz
< −4.5	Not defined	−5	−20 kHz / −200 Hz

NOTE: Input impedance is 600 ohms for both AM and FM.

2-56. The output level portion of the fixed format word is six, letter-digit pairs. This section programs two separate functions of the Model 6011A to generate the desired output level. The Amplitude D/A PCB can generate programmed voltages between 1.256V rms and 5.000V rms TERM. If voltages below this range are desired, then a portion of the 10 dB step attenuator on the Attenuator PCB must be used. ASCII character "W" and its associated digit programs the attenuation factor of the Attenuator PCB. ASCII character "Q" through "U" program the level control latches. Their associated digits program the Amplitude D/A PCB to a specific level into the Attenuator PCB. When this specific level is processed through the programmed attenuation, the programmed level appears at the Model 6011A output.

2-57 To program the output level, refer to the table in the output level section of Figure 2-4, Model 6011A Fixed Remote Programming Format. Find the range that the desired output level falls within, being sure to stay under the appropriate column TERM or OPEN. Going to the left of that range, the ASCII character pair "W(n)" is listed under the "Command" column. Record the number in the "Factor" column. This factor multiplied by the desired output level will yield a string of digits that are the commands for the Amplitude D/A PCB. The five MSD's of this number are the digits that are entered following each letter "Q" through "U", MSD through LSD respectively.

NOTE

When the AM function is selected, if the desired output level is in any range requiring more than 0 dB attenuation, the digit inputs to the Amplitude D/A PCB should be divided in half after being calculated as above. This insures that there is enough range in the D/A converter of the Amplitude D/A PCB to accomodate maximum AM.

CAUTION

When programming level, care should be taken that intermediate steps of programmed level do not create an output voltage that may damage the instrument connected to the OUTPUT of the Model 6011A.

2-58. The ASCII character "P" will clear all entered data. It is not necessary to use this character when entering new data as the data is written over. "P" is useful when transient levels must be avoided during new command sequences.

2-59. The following is a sample of fixed programming example:

1. Desired parameters are:
   Frequency = 9.87654 MHz
   AM enabled
   Output Level = 21.43 mV rms, TERM.

2. Coding the fixed format program word.
   a. The frequency needs no coding.

   b. Range is obviously high, AM is enabled, FM is not enabled, so the "J" digit is "5".

   c. The desired output level falls within the "W4" range and the factor is X200. This indicates that the attenuation factor is 40 dB. Coded voltage is 4.246V rms.

3. The resulting fixed format program word is:

A9 B8 C7 D6 E5 F4 J5 W4 Q4 R2 S4 T6 U0

The remote device should enter the word as shown converted into standard ASCII Format.

2-60. The Typical Processing Times indicated on Figure 2-4, Model 6011A Fixed Format Remote Programming Format should be considered when setting up the routine in the remote programming unit. In addition, the D/A converter on the Amplitude D/A PCB has a settling time of 360 milliseconds. (This settling time is signalled on the standard interface and RS-232C interface.)

2-61. FREE FORMAT

2-62. The free format of remote programming provides freedom of parameter selection almost equal to that of the front panel controls on the Model 6011A. Excepting the ACTUAL, LAST, and OUTPUT controls, every function of the Model 6011A front panel is represented in the free format by an ASCII character. Some of the functions require a numeric entry to define the use of that function. Refer to Table 2-4 Model 6011A Free Format Character Definitions during this description. Note in this table that the necessity of a numeric modifier and the position of that numeric modifier in relation to the letter character it modifies is denoted by (n).

Table 2-4. Model 6011A Free Format Character Definitions

ASCII ADDRESS	ADDRESSED POSITION	TYPICAL PROCESSING TIME (msec)	ASSOCIATED NUMERIC	TYPICAL PROCESSING TIME (msec)
A(n)	Am: Amplitude	0.3	n=0=AM Off n=1=AM On	7.8
D	Decrement: decreases edited digit for each "D"	33.5 for frequency 80 for volts, 200 for dB	None	
E(n)	Exponent of 10: calls for scientific notation of the input digits. Negative exponents may be entered by sending a minus sign immediately after the E, then the exponent's integer value.	0.3	Following numeric may range from 9 to −9.	1.2
F(n)	FM: Frequency Modulation	0.3	n=0=FM Off n=1=FM On	
G(n)	Select Frequency: selects edit decade in frequency display.	0.3	109.9999 Freq. Display n 123 4567	2.5
(n)H	Hz: Hertz	22	See text for formats preceding numerics	1.5, except first numeric sequence is 2.5
I	Increment: Increases edited digit for each "I" sent.	33.5 for freq., 80 for volts, 200 for dB.	None	
L	Low Range	18	None	

Table 2-4. Model 6011A Free Format Character Definitions (cont)

ASCII ADDRESS	ADDRESSED POSITION	TYPICAL PROCESSING TIME (msec)	ASSOCIATED NUMERIC	TYPICAL PROCESSING TIME (msec)
R(n)	Recall: from storage	1.1	1 thru 9 storage locations < Level Limit Location = Reference Level Loc. > Reference Freq. Loc.	95 if level stored as voltage, 215 if level stored as dB
S(n)	Store: in numbered, level limit or reference locations.	0.3		5.6
U	High Range: selects high range.	18	None	
(n)V	Volts: selects level in volts rms.	31 (36 if AM is on)	See text for formats of preceding numerics	1.5, except first numeric in sequence is 2.5
W(n)	Select Level: selects edit decade in level display	0.3	5.000 Level Display n 1 234	2.6
X(n)	Step Size: selects amount that an edited digit will change when "I" or "D" is sent.	0.3	1 thru 9	1.2
(n)Y	Decibel: selects level in dBm	215	Numerics may range from +81.99 to –81.99; see text.	1.5, except first numeric in sequence is 2.5
+	Plus sign:	1.25		
–	Minus sign:	1.25		
.	Decimal Point:	1.6		
?	Processor Inquiry:			
CR	Carriage Return			

2-63. To select free format over fixed format, pin 19 on J4, the Remote Control connector, on the rear panel must be grounded or held below 0.8V dc by a TTL gate.

2-64. The free format ASCII characters may be divided into six functional sections; frequency programming, level programming, editing, modulation selection, modifiers (+, –, .), and store/recall programming.

2-65. Frequency programming is accomplished by the use of two ASCII characters - "H" (Hz) identifies word as frequency, and "E" (scientific notation) determines the decimal place. Up to seven digits of the desired frequency may be entered. Location of the decimal place is identified by "E" followed by a number from –9 to +9 to indicate the power factor (the range is in steps of 1 log base 10). The character "H" follows the power factor designator to indicate that this is a frequency word. The Model 6011A will automatically select the appropriate display range (MHz, kHz, and Hz) for the data entered. For example:

1. 1045 E 3 H is entered, 10.45000 MHz is displayed.

2. 1045 E 0 H is entered, 1.0450 kHz is displayed.

3. 1045 E –2 H is entered, 10 Hz is displayed.

2-66. Below 110 kHz, the display may be selected in either High range units (LSD is 10 Hz) or Low Range units (LSD is .1 Hz). ASCII character "U" selected High Range resolution, "L" selects Low Range resolution.

2-67. Level programming is accomplished by the use of three ASCII characters - "V" for and output of in V rms, "Y" for and output in dBm, and "E" (scientific notation) to determine the decimal place. Up to four digits of the desired voltage may be entered. If the decimal point is not in the desired position, "E" should be entered next followed by the appropriate power factor (–9 through +9), Identify the word as an output level word and define

the units by entering either "V": for V rms or "Y" for dBm. For example:

1. 1V is entered, 1.000V is displayed.
2. 1234 E –3 V is entered, 1.234V is displayed.
3. 1234 E –4 V is entered, 123.4 mV is displayed.
4. 10 Y is entered, 10 dB is displayed.
5. 1234 E –2 Y is entered, 12.34 dBm is displayed.

NOTE

A (–) sign may only be used with volts if there is a larger positive voltage strobed as Reference Level, that is, the Model 6011A is incapable of producing a negative output level.

2-68. Edit programming exactly duplicates the function of the Model 6011A Edit Controls. Five ASCII characters are used to determine the edit function. "G(n)" and "W(n)" characters correspond to the Decade switch in function. "G" denotes that editing will be performed in the frequency register. "W" denotes editing will be performed in the level register. In both cases, (n) identifies the digit to be edited. "I" (Increment) and "D" (Decrement) correspond in function to the Digit switch. Each entry of "I" or "D" is like changing the setting of the Digit switch one position; it alters the digit selected by the step size programmed. "X(n)" programs step size. "X" denotes step size programming and (n) defines the size of the step. Both frequency and level may be swept.

NOTE

The characters "X" (Step Size), "S" (Store), and "R" (Recall) are mutually exclusive. All three characters function the same as a two position pushbutton switch. That is, entering the character changes the state of that function, it does not place the instrument in that mode. For example, the Model 6011A is in the "X" mode, entry of the "S" character will place the instrument in the Store mode. Entry of the "S" character again will remove the instrument from the Store mode. To insure that the instrument is in the proper mode, program one of the other characters in this series before it. For example:

Enter SX for "X" mode.

Enter SR for "R" mode.

Enter RS for "S" mode.

2-69. Modulation is enabled or disabled remotely with ASCII characters "A(n)" (AM) and "F(n)" (FM – only if -03 Option is installed). If (n) is "1" modulation is enabled. If (n) is "0" modulation is disabled.

2-70. Three modifying ASCII characters may be programmed: "+", "–" and ".". The characters function conventionally.

2-71. The Storage/Recall functions of the free remote format duplicate the respective front panel controls. Frequency, modulation, output level, and High/Low range may be stored in any of nine memory locations. Reference Frequency, Reference Level, and Level Limit may be stored.

2-72. Store is accomplished with ASCII character "S(n)", Recall with "R(n)" where (n) addresses the memory location. The sequence of commands is exactly like programming from the Model 6011A front panel. Remember that "S", "R", and "X" are mutually exclusive and toggle in and out of mode as described in the Note following the description of the function of "X". An example problem:

1. It is desired to Store 100 kHz at a level of 250 mV in memory location number 3.

Sequence of Commands	Meaning
1E5H	enters 100 kHz
25E-2V	enters 250 mV
R* S3	Store in memory location 3

2. It is desired to Recall the contents of memory locations 3, 4, 5, and 7 in sequence then leave the Recall mode.

Sequence of Commands	Meaning
S* R3457R	Recall memory locations 3, then 4, then 5, then 7. Exit Recall mode.

* Note: These characters are entered to insure that the instrument is not already in the mode of the following character.

2-73. The ASCII characters for Reference Frequency, Reference Level, and Level Limits are ">", "=", and "<", respectively. If all three functions are desired, Level Limit must be programmed first. As with the front panel controls of the Model 6011A, the frequency or level word is programmed, then the Store character, and then the

function character. To exit any of these three modes, enter the appropriate character alone. When programming data to modify Reference data, be sure the resultant frequency is not below 0 Hz and the resultant level is not below 0.3972V rms. These are the lower limits of the Model 6011A capabilities. When exiting from either Reference mode, the modifying data will automatically remain as the program for instrument output. Insure that these programmed functions do not fall below the instrument's capabilities either. Clarifying examples follow.

1. It is desired to Store 10 MHz as a Reference Frequency, 2.5V as Reference Level and 5V as a Level Limit.

Sequence of Commands	Meaning
5V	enters 5V
RS<	Stores 5V as Level Limit
1E7H	enters 10 MHz
2.5V	enters 2.5V rms
RS>	Stores 10 MHz as Reference Frequency
RS=	Stores 2.5V rms as Reference Level

2. Using the programmed data from Example 1, it is desired to modify frequency to 9 MHz and level to 1V.

Sequence of Commands	Meaning
-1E6H	Subtract 1 MHz from Reference = 9 MHz
-1.5V	Subtract 1.5V from Reference = 1V

Note: If ">" and "=" were entered now, the Reference Frequency and Reference Level would be removed leaving -1 MHz and -1.5V programmed both frequency and level displays would be flashing. (If programmed frequency is 1 MHz or above, the Display Overload indicator and -.0000000 will be flashing for frequency. If programmed frequency is below 1 MHz, the programmed frequency will be flashing.)

2-74. CHANGING OUTPUT IMPEDANCE

2-75. The output impedance of the 6011A, as seen from an external device, may be altered by placing an external resistor in series with the 6011A output as shown in Figure 2-5. The accuracy of the output level is dependent on the tolerance of the external resistor used. A 75Ω output impedance is available with Option -10. (With this option, the instrument is programmed for the correct 0 dBm level.)

2-76. With the output impedance altered, a new 0 dBm level must be programmed. 0 dBm levels for output impedances of 50Ω, 75Ω, 135Ω or 600Ω can be internally programmed by changing the position of two jumper wires on the Main PCB. The location of the jumpers is shown in Figure 2-6 and the position that these jumpers must be in to program the 0 dBm level for each output impedance is listed in Table 2-5. The 0 dBm level may also be calculated and stored as REFERENCE LEVEL. Table 2-6 lists the level to be programmed for standard impedances. The 0 dBm level may also be calculated for any other output impedance using the following formula: $E = \sqrt{PR}$.

For example: Change output impedance to 600Ω.

dBm at 600Ω = voltage at 1 mV into 600Ω

$E = \sqrt{PR} = 774.5$ mV

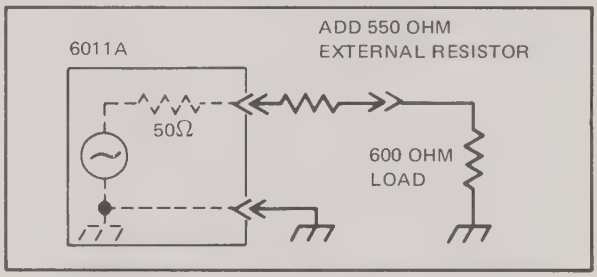


Figure 2-5. External Variation of Output Impedance

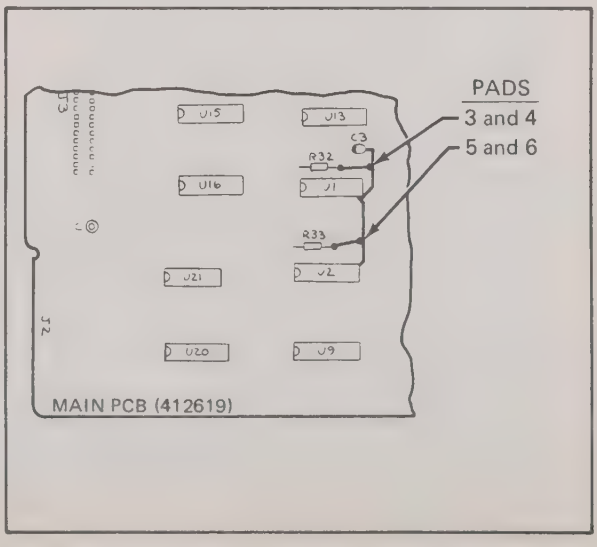


Figure 2-6. Output Impedance Jumper Location

Table 2-5. Jumper Location

Desired Output Impedance	Main PCB (412629) Jumper Configuration	
	3-4	5-6
50Ω	OPEN	OPEN
75Ω	SHORT	OPEN
135Ω	OPEN	SHORT
600Ω	SHORT	SHORT

Table 2-6. External Impedance Chart

IMPEDANCE Zo (ohms)	0 dBm REF LEVELS	EXTERNAL RESISTOR for 6011A	6011A OUTPUT RANGE in dBm into Zo
50 ohms (Standard)	223.6 mV	None	+26.98 to –55.01 dBm into 50 ohms
75*	273.8	25 ohms	+25.22 to –56.76 dBm into 75 ohms
135*	367.4	85	+22.67 to –59.32 dBm into 135 ohms
150	387.2	100	+22.21 to –59.78 dBm into 150 ohms
300	547.7	250	+19.20 to –62.79 dBm into 300 ohms
600*	774.5	550	+16.19 to –65.80 dBm into 600 ohms
900	948.6	850	+14.13 to –67.56 dBm into 900 ohms
1200	1.095V	1150	+13.19 to –68.80 dBm into 1200 ohms

** If desired, these values can be set internally, no external resistor or REF LEVELS necessary, see Table 2-5.*

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. Section 3 deals with the theory of operation of the Model 6011A Synthesized Signal Generator. The text will be divided into two parts: a basic functional description called Simplified Schematic Analysis and a detailed description called Circuit Analysis.

3-3. SIMPLIFIED SCHEMATIC ANALYSIS

3-4. The Simplified Schematic Analysis is a basic functional discussion that starts by describing the programming of the desired signal parameters into the Model 6011A and the basic controller (microprocessor) functions. How the instrument converts these programmed instructions into an output frequency at a programmed level will then be described (AM and FM will be brought in at the appropriate times). This analysis will be illustrated by Figure 3-1.

3-5. The desired signal parameters may be programmed into the Model 6011A controller from either the local station (keyboard and displays on the A1A1 Front Panel Display PCB) or a remote station. Programming will be in ASCII for the standard instrument or IEEE 488 (-05 Option) or EIA Standard RS-232C (-06 Option) with the appropriate option selected. For more detailed information refer to Section 2, Operation Instructions, or Section 6, Options and Accessories.

3-6. The controller converts these programmed signal parameters into a series of machine function commands. Controller Frequency Commands program the Six-Digit Generator PCB to produce the programmed frequency. Controller Level Commands program the Amplitude D/A PCB to adjust the instrument output level to the programmed voltage. The other controller commands control FM, AM, Hi/Lo Range selection, and attenuation selection.

3-7. The Six-Digit Generator PCB converts the Frequency Commands from the controller into an output signal that is the programmed frequency (High Range) or 100X programmed frequency (Low Range) riding on a 20 MHz carrier. The three decade step loops generate the proper digits for each decimal place of the frequency word. Consider the frequency word D.DDDDD with the LSD being labeled the "A" digit and the MSD being labeled the "F" digit with all intervening digits labeled in sequence. The six digit frequency word is F.EDCBA MHz. The A-B Decade Step Loop generates the "A" and "B" digits, the C-D Step Loop the "C" and "D" digits and the E-F Step Loop the "E" and "F" digits plus a "1" carry over capability into a seventh decimal place. Normally to assemble the frequency word, the E-F Step Loop output would be divided by unity, the C-D Step Loop output would be divided by 100 and the A-B Step Loop output would be divided by 10,000 and the quotients would be summed. The Model 6011A instead uses a reference frequency for the A-B Step Loop that is 1/4 that of the E-F Step Loop and a reference frequency for the C-D Step Loop that is 1/2 that of the E-F Step Loop and then divides the output of the C-D Step Loop by 50 and the output of the A-B Step Loop by 2,500 before summing the quotients. The signal from the Six-Digit Generator PCB will be between 20 and 31 MHz.

3-8. The Amplitude D/A PCB converts the Level Commands from the controller into a drive signal to the level amplifier on the Input/Output PCB that will adjust the instrument output to the programmed level. Feedback from the output is accomplished by an RMS sensor circuit on the Input/Output PCB. AM will be encoded on the drive signal from the Amplitude D/A PCB.

3-9. Instrument timing originates on the Input/Output PCB with a 10 MHz TCXO. (An External Reference may be substituted or the -02 Option may substitute Phase Locked reference frequencies.) This basic timing signal

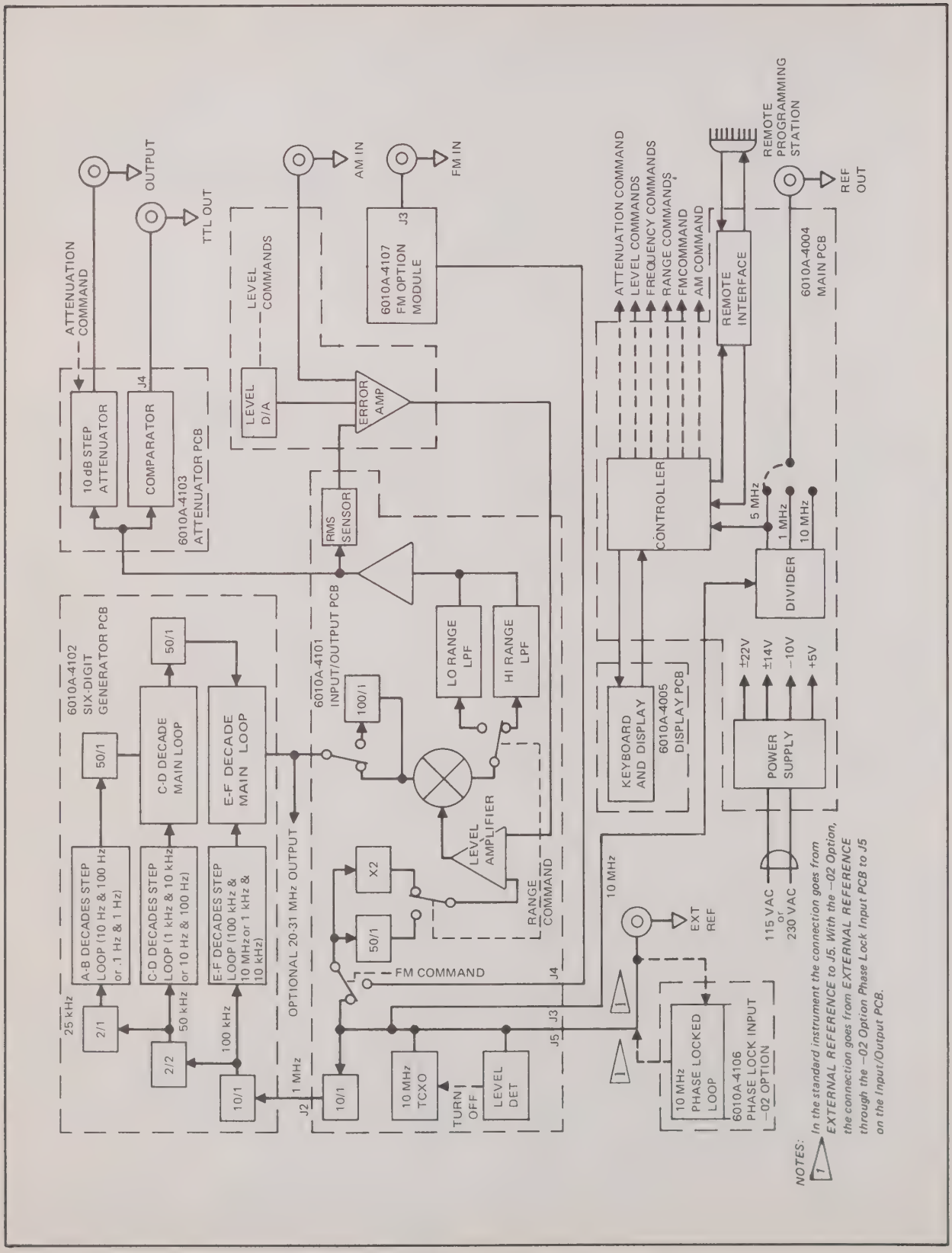


Figure 3-1. Model 6011A Simplified Schematic

goes to a divider circuit on the Main PCB to be used as a reference for the controller clock or the Reference Output. The basic timing signal also goes through a 10/1 divider and then to the Six-Digit Generator PCB where it is divided by ten again and becomes the reference frequency for frequency generation. Either the basic timing signal or the FM signal may be selected by the FM Command from the controller (if the -03 FM Option is installed) as the input to the X2 multiplier and the 50/1 divider.

3-10. Circuitry on the Input/Output PCB combines the various signals described previously to produce one signal which when processed through the 10 dB step attenuator on the Attenuator PCB becomes the programmed synthesized signal. Basically the output of the Six-Digit Generator PCB is mixed with a signal from the level amplifier which demodulates the carrier signal, sets the level and encodes AM and FM. Signal routing is different depending upon whether the Range is High or Low.

3-11. The Range Command from the controller makes three signal routing decisions on the Input/Output PCB: demodulation signal into the Level Amplifier, input circuitry for the signal from the Six-Digit Generator PCB and selection of the proper LPF on the output of the mixer. If the Range is High, the X2 multiplier sends a 20 MHz signal to the Level Amplifier, the input from the Six-Digit Generator (20 MHz + programmed frequency) goes directly into the mixer, and the output of the mixer passes through the High Range LPF. The output of the mixer is the programmed frequency at the proper level and may be AM and/or FM. This output is processed through the High Range LPF through an output amplifier to the Attenuator PCB. In the Low Range, the 50/1 divider output (.2 MHz) is selected as the demodulating frequency input to the Level Amplifier, the signal from the Six-Digit Generator PCB (20 MHz +100X programmed frequency) is routed through a 100/1 divider, before going to the mixer. The output of the mixer is programmed frequency at the proper level and may be AM and/or FM. This output is processed through the Low Range LPF and an output amplifier to the Attenuator PCB.

3-12. The Attenuator PCB has two functions: to process the signal from the Input/Output PCB through a 10 dB Step Attenuator to produce the programmed signal (present at the OUTPUT) and to convert the signal from the Input/Output PCB into a TTL OUT signal.

3-13. CIRCUIT ANALYSIS

3-14. The Circuit Analysis will be made by individual PCB Circuit analysis. These analyses will be made according to "A" number. Some PCB analyses will be supported by block diagrams, some by schematics in Section 8 of this manual. Some PCB analyses will be supported by both.

3-15. A1A1 Front Panel Display PCB Circuit Analysis

3-16. The Front Panel Display PCB is the local programming station for the Model 6011A. It contains all the controls, indicators and display LEDs. Circuit analysis of the Front Panel Display PCB will be referenced to the Front Panel Display PCB Functional Block Diagram, Figure 3-2. Comparison may be made with the Front Panel Display Schematic, Figure 8-4. All data links are with the Main PCB.

3-17. With the exception of three indicators and the Edit Controls, all Front Panel Display functions are gated by the Display Timing Signals ($\overline{DT1}$ through $\overline{DT8}$) from U7 on the Main PCB. The eight bits $\overline{DT1}$ through $\overline{DT8}$ are used to enable both the keyboard (front panel controls) and the LED Frequency Display. Five of the bits ($\overline{DT1}$ through $\overline{DT5}$) are used to enable the LED Level Display. Six of the bits ($\overline{DT1}$ through $\overline{DT6}$) are used in conjunction with the Annunciator Data bits $\overline{AD0}$ through $\overline{AD3}$ to enable the appropriate indicator.

3-18. Once the Frequency Data Display is enabled by the Display Timing Signals, the seven bit decoded signal from the Frequency Data Decoder (U1, U6) will illuminate the appropriate digit, ± indicator or overrange indicator. Decimal point control is exercised by the $\overline{FREQ.\ DP}$ signal from the Main PCB. The Frequency Data Decoder receives Frequency Display Data (FD1, FD2, FD4, and FD8) and a frequency display blanking command.

3-19. Once the Level Display Display is enabled by the Display Timing Signals, the seven bit decoded signal from the Level Data Decoder (U2 and U7) will illuminate the appropriate digit or ± indicator. Decimal point control is exercised through the $\overline{LEVEL\ DP}$ command from the Main PCB. The Level Data Decoder receives Level Display Data (LD1, LD2, LD4, and LD8) and a level display blanking command.

3-20. The annunciator matrix illuminates all indicators except RM, REMOTE and REDUCE LEVEL. The Annunciator Data bits ($\overline{AD0}$ through $\overline{AD3}$) work versus the six Display Timing bits ($\overline{DT1}$ through $\overline{DT6}$) to actuate the matrix.

3-21. The other three indicators, FM, REMOTE, and REDUCE LEVEL, are driven by the commands $\overline{FM\ CONTROL}$, REM, and ROL, respectively from the Main PCB.

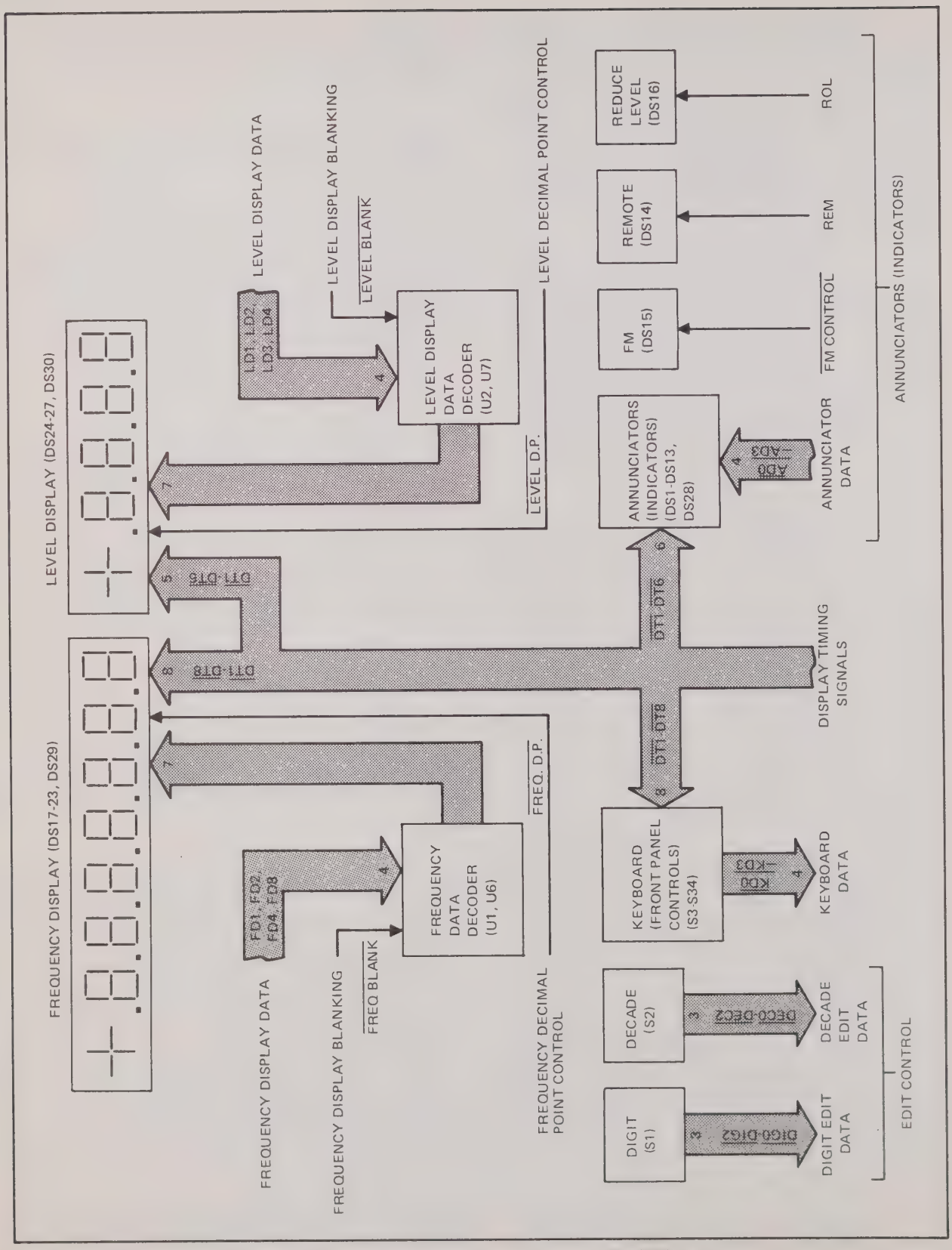


Figure 3-2. Front Panel Display PCB Functional Block Diagram

3-22. Manipulation of the front panel controls will alter the voltage references from the four by eight matrix called the "keyboard". The matrix is constructed of the eight Display Timing bits vs the four Keyboard Data bits ($\overline{KD0}$ through $\overline{KD3}$).

3-23. The Edit Controls consist of two switches, DIGIT and DECADE. Operation of the DIGIT switch changes the value of the integer selected in the Frequency Display Register or Level Display Register selected by the DECADE switch by changing the common connection from one logic bit to another ($\overline{DIG0}$ through $\overline{DIG2}$). The controller keeps track of the direction and amount of change and alters the displayed integer accordingly. The amount of change may vary from one to nine with each movement of the DIGIT switch depending on the step size programmed. The DECADE switch works exactly like the DIGIT switch, shifting the common from one data bit to another ($\overline{DEC0}$ through $\overline{DEC2}$). The integer selected is displayed as brighter than the rest of the integers in either display register.

3-24. A2 Main PCB Circuit Analysis

3-25. The A2 Main PCB contains instrument controller and power supplies. The controller will be analysed referring to the Main PCB Functional Block Diagram, Figure 3-3. Comparison may be made with the Main PCB Schematic, Figure 8-6. Analysis of the power supplies will be referenced to the Main PCB Schematic, Figure 8-6.

3-26. CONTROLLER

3-27. The controller of the Model 6011A translates front panel and remote programming commands into machine function controls and data. It sends the coded frequency commands to the Six-Digit Generator PCB which causes the programmed frequency to be generated. It sends the coded level data to the Amplitude D/A PCB to generate the programmed voltage out. The controller also sends out the data routing commands such as Range selection, Attenuator Commands, AM Command, and FM command that enable the proper processing of the generated frequency and voltage so that the signal out is as programmed. The controller displays the frequency and level and illuminates the appropriate indicators.

3-28. The controller CPU is a standard 4040 chip (U26). This CPU indirectly controls (via CPU Interface U29) the I/O circuitry and a bank of ROMs and directly controls a bank of RAMs. The CPU generates the SYNCH pulse that coordinates these sections. The CPU receives data and programming via the CPU Interface; a two phase non-overlapping clock signal, RESET and STOP signals from the Clock generator (U24); and an interrupt signal from the Remote Programming Interface (U22).

3-29. The bank of four RAMS (U27, U28, U41, and U42) receive four bit data (D0 through D3) both clock phases, reset and synch pulses. They store and output the following:

RAM 0 - Frequency and Level Decimal Point Control and Display Blanking.

RAM 1 - AM Control Command and if -03 Option is installed, FM Control Command.

RAM 2 - Attenuator Control Commands and Annunciator Blanking.

RAM 3 - Amplitude Level Data Programmed.

3-30. The CPU Interface is the nexus of the controller. It is connected to all five data buses (CPU Data, ROM Address, ROM Data, I/O Data, and I/O Address), receives both clock phases, reset, synch and ROM command pulses. Through it, the CPU is programmed, receives, processes, stores, and transmits commands and data.

3-31. The ROM bank contains the instrument program. This program sets the specific function cycle of the CPU, thereby the functions of the instrument.

3-32. The Input Multiplexer U1 through U4 codes data from the keyboard (front panel controls), the edit controls, and remote programming unit into a four bit word on the I/O Data Bus. It is addressed directly via the I/O Address Bus and is strobed by the Input Strobe pulse from the CPU Interface.

3-33. The Output circuitry consists of twelve chips that receive four bit data via the I/O Data Bus. They are addressed indirectly by the I/O Address Bus via the I/O Address Decoder (U5) and are strobed directly with the output strobe pulse from the CPU Interface. The functional units of the Output circuitry and their functions are as follows:

1. Frequency Latches U10 through U16 - Latch a 25 bit word that sets up the divider ratios of the "A through F" step loops of the Six-Digit Generator PCB to generate programmed frequency.

2. Level Command Buffer U25 - Has two functions: When U5-10 is high, loads the four I/O bits into the Display Timing Generator Gate U6. During Level Data transmission time, it sends the coded programmed level to the Amplitude D/A PCB.

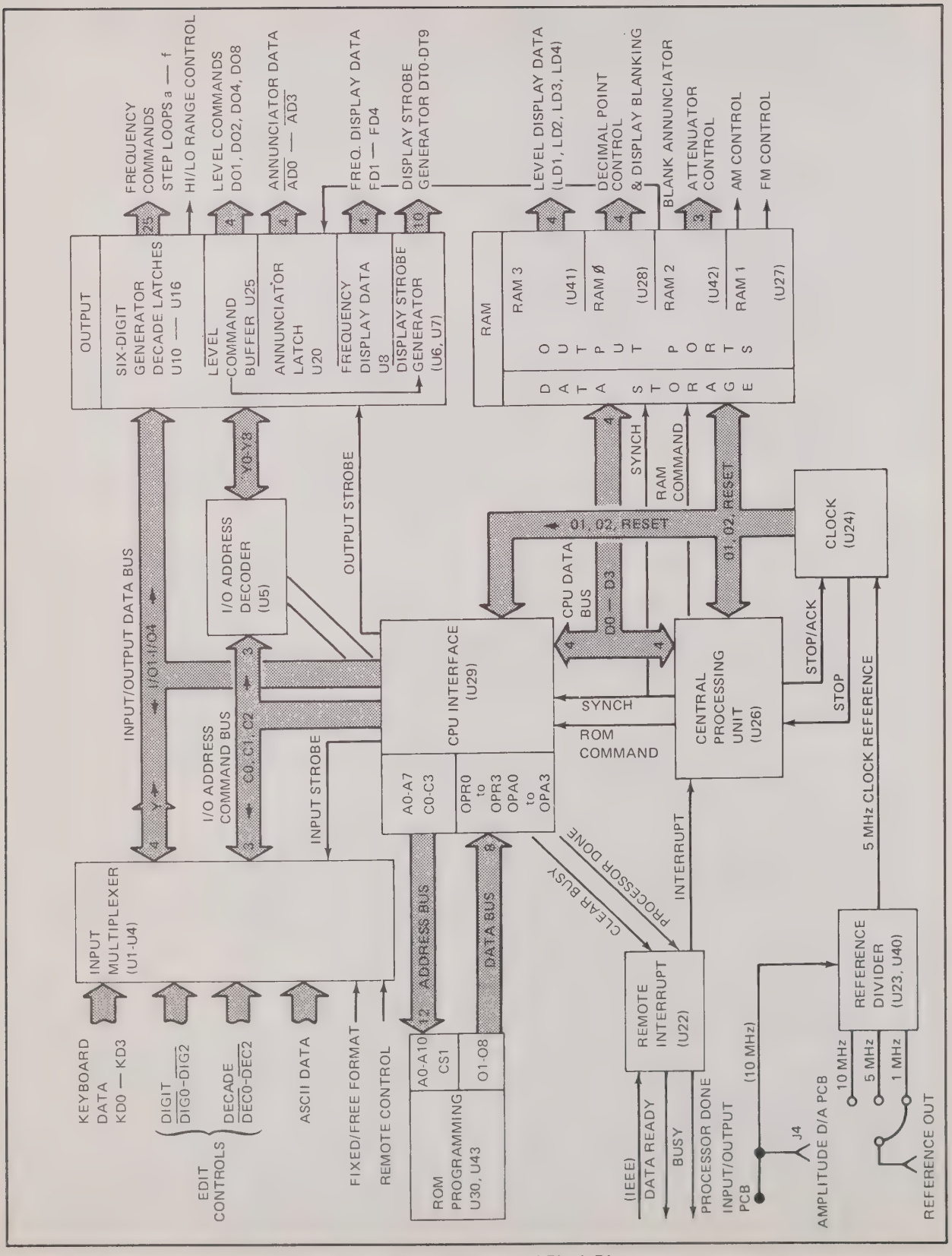


Figure 3-3. Main PCB Functional Block Diagram

3. Annunciator Control U20 - Works in conjunction with the RAM 3 output (LD1 through LD4) to illuminate the appropriate indicator. Its four data bits $\overline{AD0}$ through $\overline{AD3}$ do not control the FM, REMOTE, or REDUCE LEVEL indicators.

4. Frequency Display Data U8 - Sends four bit coded frequency display information to the Frequency Display Data Decoder on the Display PCB. These data bits are FD1 through FD4.

5. The Display Timing Generator is composed of a gating circuit U6 and a four to ten decoder U7. This circuit is loaded by I/O Address Decoder Y5 and clocked by Y0 or Y2 or Y6 (Display Freq., Display Annunciator, $\overline{DA/CK}$ respectively). These timing pulses gate the Frequency Decoder, on the Main PCB, the Level Data Latch on the Amplitude D/A PCB, and the annunciators, Frequency Display and Level Display on the Display PCB.

3-34. The Clock (U24) receives a 5 MHz reference from the Reference Divider (U23 and U40). It generates the Phase 1 and Phase 2 clock signals, RESET and STOP pulses.

3-35. The Reference Divider circuit takes the buffered 10 MHz signal from the Input/Output PCB and generates a 10 MHz, 5 MHz, and 1 MHz choice for Reference OUT. It also generates the 5 MHz reference for the controller clock.

3-36. The Remote Interface circuit (U22) coordinates timing between the controller and remote programming devices. In communicating with a remote device, it receives a Data Ready signal when there is data present to be input. It sends BUSY and PROCESSOR DONE signals to the remote programming unit to either inhibit data transmission or allow data transfer. To tell if the controller is still in mid-cycle, the Remote Interface chip receives the PROCESSOR DONE pulse, it will initiate an INTERRUPT pulse to the CPU.

3-37. CONTROLLER TIMING

3-38. Having completed a functional description of the controller, study of its basic timing cycle may be made. Refer to Controller Basic Timing Diagram, Figure 3-4.

1. All system timing is referenced to the two non-overlapping clock signals Phase 1 and Phase 2 from the Clock Generator.

2. Start cycle is initiated by the trailing edge of the SYNCH pulse from the CPU to the RAMs and the CPU Interface. SYNCH is initiated by the trailing edge of Phase 2 at cycle time X3.

3. During cycle time A1, A2, and A3, two functions occur:

a. The twelve data bits in the CPU program counter are transferred to the ROMs via CPU Interface in three, four bit words.

b. The Input/Output Multiplexer is scanned for new data. If there is new data at STROBE, the data will be transferred to the I/O ports of the CPU Interface, Frequency Decoder, Annunciator Control and Frequency Display Data.

4. During cycle time M1 and M2, the following occurs:

a. The eight data bit instruction is transferred from the ROMs to the CPU via the CPU Interface in two, four bit data words and is decoded.

b. M1 - CM RAM, RM ROM will be generated for any single cycle instruction or during the first cycle of a double cycle word. If generated at this time, the timing feature allows external logic to be distinguished from instructions, addresses or data during instruction time M1 and M2.

c. M2 - CM RAM or CM ROM will generate for any I/O operation.

5. During the cycle times X1, X2, and X3, the following occurs:

a. Instructions are executed.

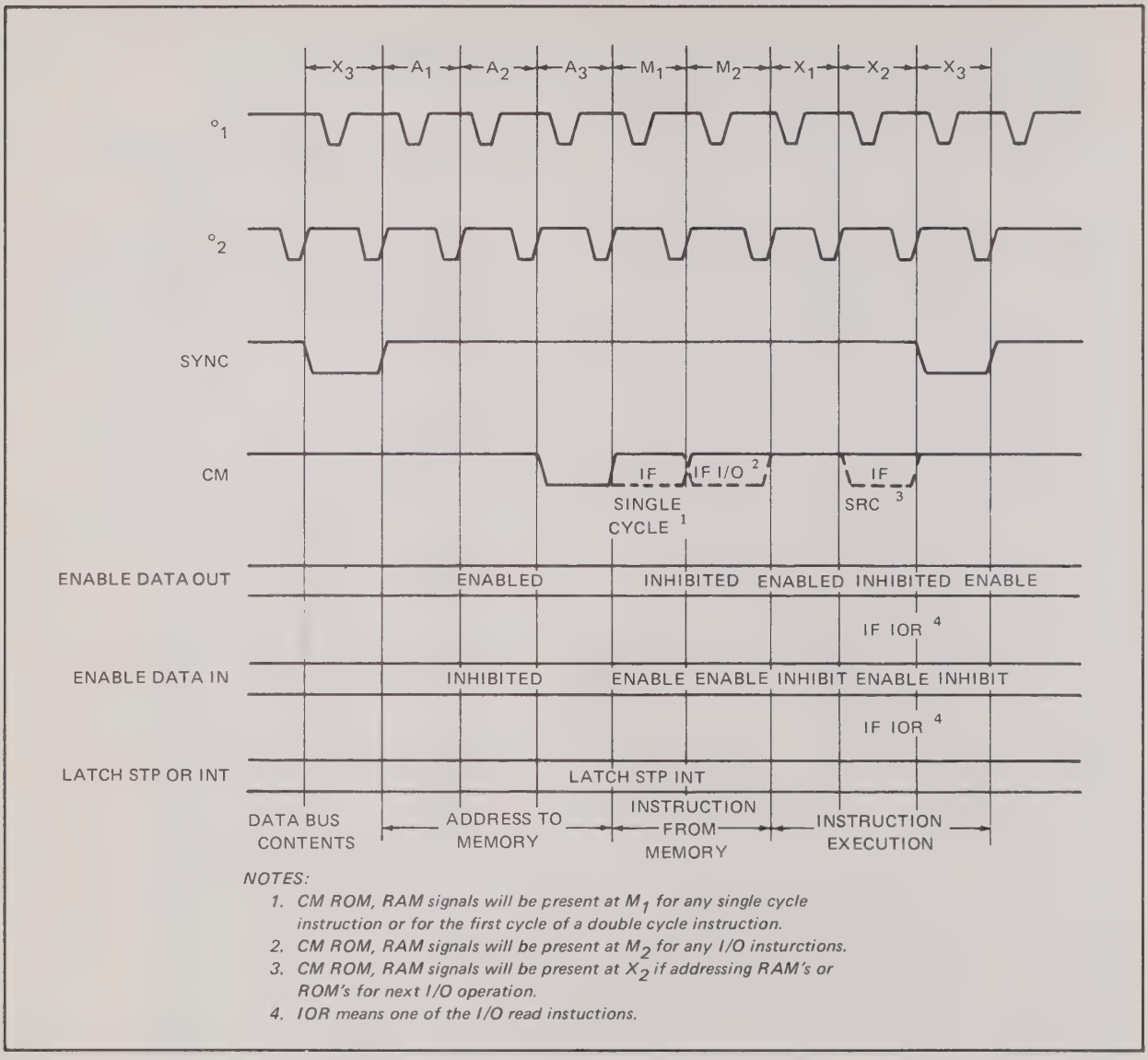
b. X1 - CPU signal for debugging is generated.

c. X2 - If addressing RAM or ROM for the next I/O operation, CM RAM, CM ROM are generated.

d. X3 - SYNCH is generated.

3-39. POWER SUPPLIES

3-40. The power supply on the Main PCB provides +5V, -10V, ±14V, and ±22V for operating voltages and logic levels. Input line power is applied to the primary of the main power transformer T1 via the POWER OFF/ON switch and the 115V/230V select switch. The secondary consists of two windings. One winding drives the three +5V power supplies. The other winding drives the other power supplies. Half wave rectification for the



NOTES:

1. *CM ROM, RAM signals will be present at M_1 for any single cycle instruction or for the first cycle of a double cycle instruction.*
2. *CM ROM, RAM signals will be present at M_2 for any I/O insturctions.*
3. *CM ROM, RAM signals will be present at X_2 if addressing RAM's or ROM's for next I/O operation.*
4. *IOR means one of the I/O read instuctions.*

Figure 3-4. 6011A Controller Basic Timing Diagram

+5V power supplies is accomplished by diodes CR3 and CR4. Full wave rectification for the other power supplies is accomplished by diode bridge CR1.

3-41. The +5 volt power supplies all use the same type linear voltage regulator chip. Three power supplies are used to insure logic isolation between the Main PCB, Input/Output PCB, and the Six-Digit Generator PCB.

3-42. The +22V and +14V are both regulated by the linear voltage regulator U33. The +14 volts is further regulated by series regulator Q1 and associated controller U31.

3-43. The -22V and -14 volts are both regulated by the linear regulator U34. The -14V is further regulated by series pass element Q2 and its controller U32. Q3 is added to compensate for the use of U32 with a negative voltage.

3-44. The -10 volts is regulated by U38. U38 is the same type linear regulator as U33 and U34. It puts out only -10 volts due to the triple diode to common connection CR2.

3-45. A3 Input/Output PCB Circuit Analysis

3-46. The Input/Output PCB has seven major circuit functions:

1. Instrument timing with output dividers and optional features (including FM).

2. Range control circuit.

3. A level control amplifier.

4. An RMS sensing circuit for feedback of amplitude information to the Amplitude D/A PCB.

5. The input circuitry that processes the output frequencies from the Six-Digit Generator PCB.

6. The mixer circuit that combines the signal from the Six-Digit Generator PCB and the signal from the level control amplifier circuit.

7. Output circuitry to the Attenuator PCB.

3-47. INSTRUMENT TIMING CIRCUITRY

3-48. The heart of the instrument timing during standard operation is the 10 MHz TCXO U14. Its 10 MHz output is coupled through U8 to the control circuitry on the Main PCB (J3). The 10 MHz output also goes through a 10/1 divider U5 and is sent to the Six-Digit Generator PCB via J2 as the 1 MHz Reference Frequency. During standard operation, the 10 MHz will also go to both an X2 Multiplier U10 and a 50/1 divider U6 to become the beat frequencies for High Range and Lo Range demodulation of the Six-Digit Generator PCB output (20 MHz or .2 MHz plus programmed frequency). Two mutually exclusive options, the -02 Phase Lockable Input and the -03 FM, affect the instrument as follows.

1. -02 Phase Lockable Input Option - The selected Standard Frequency (10, 5, 2.5, 2, or 1 MHz) enters the Input/Output PCB via J5. This input goes to the level detector U7 to disable both the output and power to the 10 MHz TCXO. The Standard Frequency also passes through a portion of gating chip U8 and replaces the 10 MHz TCXO signal in all its functions.

2. -03 FM Option - If the instrument has the -03 Option, programming FM will cause the FM Control signal (P9-6) to disable the 10 MHz TCXO signal from and enable the FM IN (J4 from the FM PCB) to the X2 multiplier and 50/1 divider. These provide the frequency signal to the level control amplifier.

3-49. RANGE COMMAND CIRCUITRY

3-50. The Range Command from U10 on the Main PCB makes three logic switch selections on the Input/Output PCB when programmed frequency passes above 110 kHz. Below 110 kHz, the Low Range is automatically enabled. At or above 110 kHz, the High Range is automatically enabled. These automatic signals may be overridden manually with the front panel control RANGE OVERRIDE. This control only functions for frequencies below 110 kHz and is used to change resolution (0.1 Hz for Low Range and 10 Hz for High Range). The Range Command is input to inverter U4 and diode CR19.

3-51. The Range Command signal to CR19 determines which Low Pass Filter will be used at the output of the instrument. CR19 controls Q30 which in turn controls Q21, Low Range LPF Select, and Q24, High Range LPF Select.

3-52. The Range Command input to inverter U4 determines two things: Whether the X2 multiplier (20 MHz) or the 50/1 divider (.2 MHz) input is used by the level control amplifier circuit. Whether the frequency output from the Six-Digit Generator PCB (J1) will go directly to the mixer U12 (High Range - 20 to 31 MHz) or will pass through the 100/1 divider U2 and U3 before being input to the mixer (Low Range - .2 to .31 MHz).

3-53. LEVEL CONTROL AMPLIFIER

3-54. The level control amplifier circuitry U13 and U16 combine a frequency signal from the instrument timing section and an AM/level signal for the Amplitude D/A PCB. The AM/Level Analog signal (P9-2) from the Amplitude D/A PCB passes through Op Amp U15 to the level control network U13. U13 is a differential amplifier - gain controlled by emitter current. In High Range, U13 will be properly terminated by L15 and L16, in Low Range by L17 and L18. Only one of these circuits will have an output at a time. The L15 and L16 network applies its input to the High Range input port of the mixer (U12-4). The L17 and L18 network applied its input to the Low Range input port of the mixer (U12-1). The frequency of the signal at the mixer input ports is either the selected reference signal or the FM signal. Amplitude of the signal at the mixer input ports is a function of programmed level and AM.

3-55. RMS SENSOR CIRCUITRY

3-56. The RMS sensor circuitry is composed of U11, U16, U17 and Q26. It processes the sense signal from the output amplifier into a signal proportional to RMS value of the output amplifier output level. This RMS signal is sent to the Amplitude D/A PCB as a correction voltage for programmed level.

3-57. INPUT CIRCUITRY

3-58. For the High Range, the input frequencies from the Six-Digit Generator PCB (J1) pass through gating circuitry U1 to the pin 8 input of the mixer. For Low Range, the gating circuit U1 routes the output of the Six-Digit Generator PCB through 100/1 divider U2 and U3 before routing it to the pin 8 input of the mixer. The frequency at pin 8 of the mixer will be 20-31 MHz for High Range and .2 to .31 MHz for Low Range operation.

3-59. MIXER CIRCUITRY

3-60. The mixer circuitry is composed of U12, Q2 through Q5 and Q15. This circuit effectively subtracts the level control amplifier output from the processed signal from the Six-Digit Generator PCB. During operation the Six-Digit Generator PCB output is 20 MHz + programmed frequency for High Range and 20 MHz + programmed frequency for Low Range and the output of the level control amplifier is 20 MHz (High Range) or .2 MHz (Low Range) with programmed level and AM encoded. Therefore the output of the mixer is the programmed frequency at the programmed level with the possibility of AM. Option -03 will also allow FM encoding upon this output.

3-61. OUTPUT CIRCUITRY

3-62. The output of the mixer passes through either the Low Range Low Pass Filter Q27 and Q28 or the High Range LPF Q25 and Q31 to the output amplifier. The output amplifier is composed of Q6 through Q14, Q17, Q22, Q23, Q29 and U18. The output goes to the Attenuator PCB for final processing before appearing at the 10 Hz-11 MHz connection. A portion of the signal is tapped off the junction of R54 and R55 as a sense signal for the RMS sensor circuit.

3-63. A4 Six-Digit Generator PCB Circuit Analysis

3-64. INTRODUCTION

3-65. The Six-Digit Generator PCB uses a reference frequency (1 MHz) from the 10/1 divider on the Input/Output PCB to convert the Frequency Commands from the controller into the programmed frequency. The frequency out of the Six-Digit Generator PCB is the programmed frequency (High Range) or 100X programmed frequency (Low Range) riding on a 20 MHz carrier. That is, a signal range of 20 MHz to 31 MHz.

3-66. Programmed frequency is generated in three parts simultaneously as described in the Simplified Schematic Analysis. The definition of the frequency word in the Simplified Schematic Analysis will be used in this description. Both AB and CD may range from 00 to 99. EF (with the 1 carry) may range from 000 to 109. Therefore, the frequency word may range from 00.00000 MHz to 10.99999 MHz in high range and 000.0000 kHz to 109.9999 kHz in low range. Likewise resolution will be 10 Hz in high range and 0.1 Hz in low range.

3-67. The circuitry of the Six-Digit Generator is composed of six functional sections: three step loops for generating portions of the programmed frequency word, two main loops for summing the step loop outputs, and the reference frequency circuit for providing each step loop with its appropriate reference frequency. As the step loops are approximately the same, only the A-B step loop will be described in detail. The differences and component functions will be noted for the other two step loops. The two main loops are also similar so only the C-D main loop will be described in detail. The differences and component functions will be noted for the E-F main loop.

3-68. To facilitate comprehension of the circuitry and the instrument output, a mathematical model of the Six-Digit Generator PCB will be made at the end of the Circuit Analysis.

3-69. REFERENCE FREQUENCY CIRCUITRY

3-70. The reference frequency from the 10/1 divider, U5, on the Input/Output PCB, enters the Six-Digit Generator PCB via J1.

3-71. The 1 MHz reference frequency enters the 10/1 divider U15 after passing through a double inverter isolation amplifier U16. An inverted 1 MHz signal is tapped off U16 and exits the Six-Digit Generator PCB via J6. The QD output of the 10/1 divider U15 is the 100 kHz reference frequency for the E-F step loop phase detector (R1 input). The QC output of U15 is the 100 kHz signal to the input of the 2/1 divider, U39A, for the D-C step loop.

3-72. The 100 kHz signal from U15 is divided down to 50 kHz by U39A. The $\overline{Q1}$ output of U39A is the 50 kHz signal to the input of the 2/1 divider, U39B, for the A-B step loop.

3-73. The 50 kHz signal for U39A - $\overline{Q1}$ is divided down to 25 kHz by U39B. The Q2 output of U39B is the 25 kHz reference frequency for the A-B step loop generator phase detector U50 (R1).

3-74. Note that the reference frequency of the A-B step loop is 1/4 that of the E-F step loop and that the reference frequency of the C-D step loop is 1/2 of the E-F step loop.

3-75. STEP LOOP

3-76. The step loops are phase locked loops as shown in the Step Loop Diagram, Figure 3-5. Altering the division factor (frequency commands) removes the loop phase lock and the phase detector will drive the VCO up or down in frequency until the output of the divider equals the reference frequency. At that time, the output of the step loop = N reference frequency. In the case of the A-B step loop, the output of the A-B step loop (fAB) = (1100 - AB) 25 kHz.

3-77. The A-B step loop circuitry consists of an N/A divider (N = 1100 to 1001), a phase detector with up

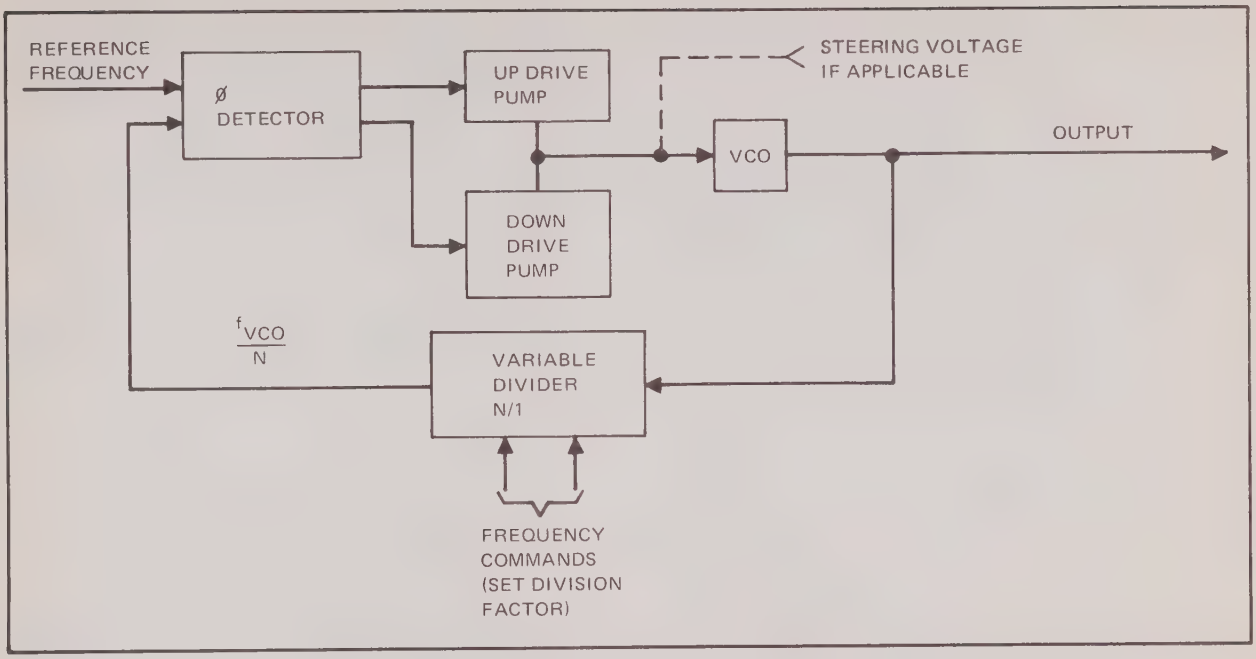


Figure 3-5. Step Loop Block Diagram

charge and down charge pumps, a VCO, a limiter amplifier and a 50/1 divider between the A-B step loop output and the C-D main loop input.

3-78. The N/1 divider is composed of U45, U46, U48, and U49. The division factor, NAB=1100 - AB, is set into the divider circuitry by the Frequency Commands from the controller. These Frequency Commands are input via U15 and U16 of the Frequency Decoder on the Main PCB. Alteration of the division factor will change the output of the divider (fAB/NAB) to the phase detector input V1.

3-79. The phase detector U50 continuously compares the output of the divider to the reference frequency and generates a drive up or drive down signal to the up charge pump (Q36 and Q37) and the down charge pump (Q25). These signals shift the voltage at the common collectors of Q36 and Q25. The voltage at this summing point is the VCO control bias.

3-80. The A-B step loop VCO is composed of Q26, Q27, and tank circuit T5, C105, and varactor diode CR12. The control component of the VCO is the varactor diode. As the bias voltage input to the VCO changes, the diode capacitance of CR12 changes. Since this is just another capacitance to the tank circuit, the frequency out of the VCO (fAB) shifts. The amount and direction of the shift in frequency fAB depends upon the polarity and level of the bias voltage. The VCO will continue to change frequency until the phase detector reaches zero comparison. At this time, the VCO output divided by the programmed division factor will equal 25 kHz, or, more apropos, fAB = 25 kHzNAB.

3-81. The output of the VCO goes through the limiter/isolation amplifier U44 to the N/1 divider and the 50/1 output divider U42 (10/1) and U29 (5/1). The output of the 50/1 divider is the R1 input to the C-D main loop phase detector U28. This R1 input is the generated digits AB shifted to their appropriate decimal position in relation to the digits CD.

3-82. C-D STEP LOOP

3-83. The C-D step loop is functionally the same as the A-B step loop with the following exceptions:

1. Reference frequency is twice that of the A-B step loop (50 kHz for standard operation).

2. Frequency control signals represent digits CD and are input from U13 and U14 of the Frequency Decoder on the Main PCB.

3. The N/1 divider has a range of N = 489-390 with N decreasing as programmed frequency increase in the CD digits.

4. C-D step loop VCO operates from 24.45 to 19.5 MHz. When the phase detector reaches zero comparison, the output of the VCO, fDC = (50 kHz) (NCD).

5. The control element of the C-D step loop VCO, varactor CR10, is matched with the C-D main loop control element, varactor CR7. The reason for this will be discussed in the next step.

6. Both the C-D step loop and the C-D main loop VCO inputs are tied together through the voltage follower/clamping circuit U37 and CR8 and CR9. As the two varactors are matched, the operating curves of the VCOs are homothetic - similar at all points and similarly oriented.

7. The output of the C-D step loop does not pass through a divider circuit before reaching the C-D main loop circuit.

3-84. The components constituting the circuits of the C-D step loop are as follows:

1. Phase Detector - U38.

2. Up charge pump - Q31 and Q39.

3. Down charge pump - Q24.

4. VCO - CR10, C77, Q22, Q23, T4.

5. N/1 divider - U32, through U36 and U47.

6. Limiter/isolation amplifier - U30.

7. Voltage follower/clamping - U13, U23, CR3 through CR5.

3-85. E-F STEP LOOP

3-86. The E-F step loop is functionally the same as the C-D step loop with the following exceptions:

1. The reference frequency of the E-F step loop is twice that of the C-D step loop and four times that of the A-B step loop. (100 kHz for normal operation.)

2. The frequency control signals represent EF and are input from U12 (E) and U11, and 17 (F) on the Main PCB via E1, pins 21, 22, 25, 26, 31, 32, 33, 8/34. The f decade overrange signal is sent from U18 on the Main PCB via E1, pin 12.

3. The N/1 divider has a range of 205 to 314 with N increasing as programmed frequency increases in the EF digits.

4. E-F step loop VCO operates from 20.5 to 31.4 MHz. When the phase detector reaches zero comparison, the output of the VCO, fEF, = (100 kHz) (NEF).

5. The voltage follower/clamping circuitry is more complex, but function in conjunction with matched varactor diodes CR1 and CR2 to insure that the operating curves of the E-F step loop and E-F main loop VCO's are homothetic.

3-87. The components constituting the circuits of the E-F step loop are as follows:

1. Phase detector - U14.

2. Up charge pump - Q8, Q9, and gain compensator Q7.

3. Down charge pump - Q5.

4. VCO - CR1, C5, T1, Q4, and Q3.

5. N/1 divider - U3 through U12.

6. Limiter/isolation amplifier - U1.

7. Voltage follower/clamping - U13, U23, CR3 through CR5.

3-88. C-D MAIN LOOP

3-89. The C-D main loop circuitry consists of a phase detector with up and down charge pumps, a VCO, a limiter/isolation amplifier, a frequency mixer and amplifier, and a 50/1 divider (as shown in Figure 3-6).

3-90. The output of the C-D step loop enters one leg of frequency mixer Op Amp U26. The other input is the frequency out of the C-D main loop VCO (fDCBA). The output of U26, fDCBA - fCD, is amplified by Q20 and is the V1 input of the C-D main loop phase detector, U28.

3-91. C-D main loop phase detector compares the difference frequency from the frequency mixer/amplifier circuit to the output of the A-B step loop 50/1 divider (fAB/50) and sends drive up or drive down signals to the up charge or down charge pump circuits. Signals from the phase detector will cause either the up charge pump Q38 and Q30 or the down charge pump Q21 to change the voltage at the summing point of the collectors of Q21 and Q30. This voltage is the input control voltage of the C-D main loop VCO.

3-92. The C-D main loop VCO, CR7, C68, T3, Q18, Q19 and associated circuitry, will shift in frequency until the phase detector reaches a null comparison. At that time, fDCBA = fCD + fAB/50 = fCD + .02fAB. This frequency is sent to the frequency mixer Q26 and the 50/1 divider via limiter/isolation amplifier U25.

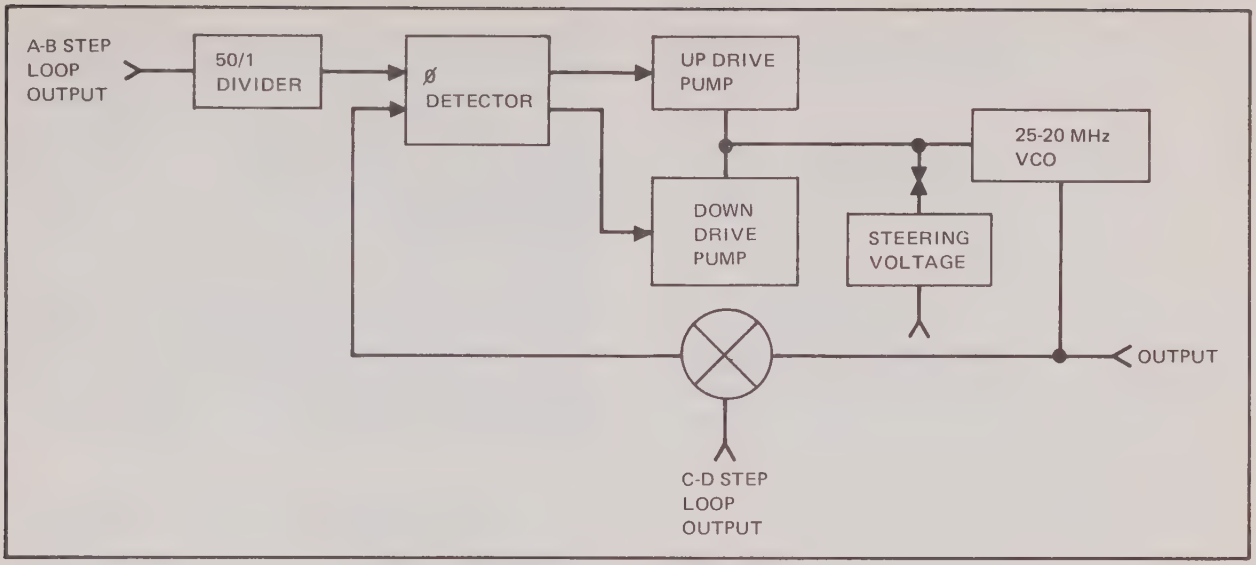


Figure 3-6. C-D Main Loop Block Diagram

3-93. The 50/1 divider is composed of 10/1 divider U24 and 5/1 divider U22. The output, fDCBA/50, is the R1 input of the E-F main loop phase detector.

3-94. E-F MAIN LOOP

3-95. As shown in Figure 3-7, the E-F main loop is functionally the same as the C-D main loop except:

1. The VCO operating range is 20 to 31 MHz during standard operation. Since the VCO output only passes through two stages of inversion (U18) before being mixed with fEF by U19, when the phase detector U21 reaches zero comparison, the VCO output, fFEDCBA, = fEF - fDCBA/50.

2. The outputs of the E-F main loop do not pass through a divider but are output 1/1 via J3 and J4.

3-96. MATHEMATICAL MODEL OF THE SIX-DIGIT GENERATOR PCB

3-97. The mathematic model of the Six-Digit Generator PCB is derived from the statement of the E-F main loop output and the circuit description of the Six-Digit Generator PCB.

$$f_{OUT} = .1\ f_{REF.}\ (N_{EF} - .01\ N_{CD} - .0001\ N_{AB})$$

WHERE:

a. $N_{AB} = 1100 - AB$
$N_{CD} = 489 - CD$
$N_{EF} = 205 + EF$

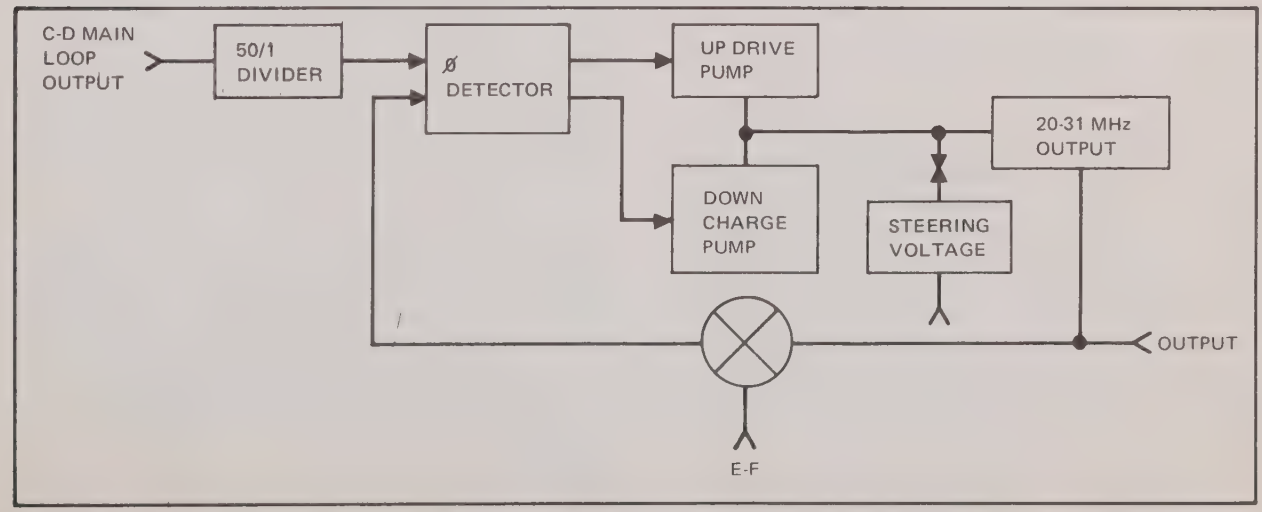


Figure 3-7. E-F Main Loop Block Diagram

b. EF, CD, and AB are the respective segments of the programmed frequency word as defined previously in this manual.

c. f_{REF} = the reference frequency from the Input/Output PCB. This is 1 MHz.

3-98. A5 Attenuator PCB Circuit Analysis

3-99. The Attenuator PCB has two functions. The first function passes the 10 Hz to 11 MHz signal from the output amplifier of the Input/Output PCB through a 10 dB/step attenuator with a range of zero to 70 dB. The second function converts the 10 Hz to 11 MHz output of the output amplifier on the Input/Output PCB into a 1/1 TTL square wave output. The circuitry is divided into three sections: the TTL converter, the 10 dB step attenuator and the attenuator selection circuit.

3-100. The TTL conversion circuitry consists of RF to square wave converter U1 and shaper/amplifier U2. One gate of U2 is used to improve the shaping of the A output of U1. The other three gates of U2 improve the Fan-Out of the TTL signal.

3-101. The 10 dB attenuator consists of a 10 dB attenuator, R6 through R8, a 20 dB attenuator, R12 through R14, and a 40 dB attenuator, R16 through R21. By bypassing or placing these attenuators in series with one another, any 10 dB step of attenuation may be selected.

3-102. The attenuator select circuit consists of relays K1 (10 dB select), K2 (20 dB select) and K3 (40 dB select) and their driver U3. The 00, 01, and 03 outputs of the RAM2 XU42 on the Main PCB drive the 10 dB, 20 dB, and 40 dB control portions of the relay driver U3.

3-103. A6 Amplitude D/A PCB Circuit Analysis

3-104. The Amplitude D/A PCB converts the digital programmed level into an analog voltage. This analog voltage is compared to the signal from the RMS sensor on the Input/Output PCB to provide a correction signal. This correction signal is then summed with the analog voltage to produce the AM/Level Analog signal. The AM/Level Analog signal is applied to the level control amplifier on the Input/Output PCB to control the instrument output level so that the instrument output level is the same as the programmed level. Figure 8-14, Amplitude D/A Schematic, illustrates this analysis.

3-105. The programmed level received by the controller is converted into output level commands and applied to the output level command latches U1 through U5. These commands are transmitted on the DO1, DO2, DO4 and DO8 data lines, clocked in by $\overline{DA/CK}$, and enabled by $\overline{DT1}$ through $\overline{DT5}$, the same timing pulses that enable data to the Level Display. The level word is latched into U1 through U5: the MSD in U1, LSD in U4 and a fine resolution digit in U5. The data will remain in these latches until new data is entered or the instrument is deenergized.

3-106. U10 and U11 form a counter that produces a carry after counting 99 pulses of the 10 MHz TTL input at J4. This carry is the LOAD pulse that places the initial count of 1 in U10 and U11 and loads the level command data into U6 through U9. This data will be loaded every 100 pulses of the 10 MHz TTL clocking signal.

3-107. The level command data latched into the output level command latches is always present at the input ports of the MSD and LSD programmable counters. Both programmable counters add each pulse of the 10 MHz clock to the level command data until a carry is generated at the outputs of the counters. These carry levels will stop the count in their respective programmable counter and places a high level on the D input of the respective switch control latch. The next LOAD pulse will reload the level data into the programmable counter removing the carry level. Removal of the carry level enables counting in the programmable counters and places a low level on the D inputs of the switch control latches.

3-108. The MSD switch control latch (U25B) and the LSD switch control latch are dual "D" flip-flops. A high level at the D input will set the switch control latch. A low level at the D input will reset the control latch. If the switch controllers are set (programmable counter still counting), the 5V reference voltage is switched to the input of the filter network. If the switch controllers are reset (programmable counters generating a carry pulse) common potential is switched to the input of the filter network. Therefore, the two sections (MSD and LSD) apply the 5 volt reference to the input of the filter network for a portion of every 100 pulses of the 10 MHz clock. The length of time the 5V reference voltage is applied depends upon the level programmed. The fine resolution bit from U5 is also applied to the input of the filter network.

3-109. The 5 volt reference that is applied to the filter network input has the AM signal encoded upon it. The 5V reference signal is taken from the output of a stable 7V reference voltage supply. The AM signal (input on J2) is switched to the input of the summing amplifier, U17B, by the AM command from the controller on the Main PCB. The reference voltage is also applied to the input of U17B. The output of U17B is the 5V reference voltage with the AM signal encoded upon it.

3-110. The input of the filter network is made up of the fine resolution bit from U5 and two signals switched

between common and the 5V reference voltage with AM. The summed, filtered output is applied to the unity gain amplifier U21 and the error signal comparator U19.

3-111. The error signal comparator (operated open loop for maximum gain) receives two inputs: the filtered analog construct of programmed level and the RMS value of the instrument output level from the RMS sensor circuit on the Input/Output PCB (DET SIG, J1). The output of the comparator is the difference between programmed level and instrument output level with AM encoded on it. This error signal is applied to the input of the output amplifier U20A, where it is summed with the output of U21.

3-112. The unity gain amplifier, U21, applies its output to the inputs of the output amplifier U20A and the overvoltage detector U20B.

3-113. If the programmed level plus AM exceeds the capabilities of the instrument, overvoltage detector, U20B, drives U24 to produce the ROL (Reduce Output Level) command.

3-114. The output amplifier, U20A, transmits the analog construct (with AM) to the level control amplifier on the Input/Output PCB. This signal (the AM/Level control signal) will alter the instrument output until the instrument output equals programmed level with AM.

Section 4
Maintenance

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRICAL SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. LINE VOLTAGE MAY BE PRESENT FROM THE LINE POWER CABLE TO THE PRIMARY OF THE POWER SUPPLY TRANSFORMER.

CAUTION

Release the power control before connecting or disconnecting modules, pcbs or cables.

4-1. INTRODUCTION

4-2. This section of the manual contains maintenance information for the Model 6011A Synthesized Signal Generator. The information contained in this section is catagorized as service information, general maintenance procedures, performance checks, first level calibration adjustments, second level calibration adjustments, and troubleshooting procedures. The performance checks should be completed upon receipt of the instrument as an acceptance check and semi-annually as a calibration check. If indicated, perform the first level calibration adjustments semi-annually. Perform the second level calibration adjustments only if the instrument has been repaired or if the first level calibration adjustments fail to bring the instrument back within operating specifications. Troubleshooting is indicated if either the first or second level calibration adjustment fails to bring the instrument within operating specifications. Test equipment required for these procedures is listed in Table 4-1, Required Test Equipment. In this manual, UUT means Unit Under Test.

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of 1-year upon delivery to the original purchaser. Complete warranty information is contained on the Warranty page located at the front of this manual.

4-5. Factory authorized calibration and repair services for all Fluke instruments are available at various world-wide locations. A complete list of factory authorized service centers is provided in Section 7, General Information. If requested, an estimate will be provided to the customer before any repair work is begun on the instrument beyond the warranty period.

4-6. GENERAL MAINTENANCE

4-7. Maintenance Access

4-8. To gain access to the major circuits of the Model 6011A, proceed as follows:

1. Release the POWER control.

2. Disconnect the Model 6011A Signal Generator from line power.

3. Remove the top and bottom dust covers. This will expose the Input/Output Module (top) and the Six-Digit Generator Module (bottom).

4. There are four screws on each side securing the Input/Output Module. Loosen the rear screw on each side.

5. Remove the other six screws securing the Input/Output Module.

6. Swing the Input/Output Module up and back until it rests against the stop. This provides access to the Attenuator Module, D/A Amplitude Module, and the Main PCB.

7. There are four screws on each side securing the Six-Digit Generator Module. Loosen the rear screw on each side.

8. Remove the other six screws securing the Six-Digit Generator Module.

9. Swing the Six-Digit Generator Module back. This provides access to the bottom of the Main PCB.

10. Logically reverse these procedures for reassembly.

11. The covers may be removed from any module and the pcb reinstalled. If the cables are of insufficient length, use the 6010A/6011A Service Kit described in Section 6, Options and Accessories.

CAUTION

The heat sink capacity on the output transistors of the Input/Output Module is greatly reduced with the module covers removed. Equipment damage may result if sufficient care is not taken.

Table 4-1. Required Test Equipment

EQUIPMENT NOMENCLATURE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Digital Voltmeter (2)	1 μV Resolution	JF 8800A or 8200A–02
Frequency Counter	0.1 Hz Resolution	JF 1953A–10
True RMS Voltmeter	±0.2% Accuracy @ 10 Hz to 30 Hz. ±0.05% Accuracy @ 30 Hz to 50 kHz.	JF 931B
Thermal Converter 5V	±0.1% Accuracy to 11 MHz	JF A55
Thermal Converter .5V	±0.1% Accuracy to 11 MHz	JF A55
50Ω Precision Termination (1)		GR874-Q50BL
GR874 to BNC Adapter		GR874-QB PAL
Reference Synthesizer	Range: 10 Hz to 11 MHz 0.1 Hz Resolution	JF 645A, 6160B or 6011A
Amplifier-Bandwidth Limited	Min. gain 1000 3 dB B/W @ 10 kHz Max. equiv. input noise of 25 μV	Tektronix AM502
Oscilloscope	100 MHz Bandwidth	Tektronix 7613A
FET Probe		Tektronix P6201
Spectrum Analyzer	–128 dB Sensitivity 30 Hz Resolution 1 kHz to 100 MHz Frequency Coverage	Tektronix 7L13
High Level Mixer	+17 dBm local oscillator input	Mini-Circuits ZAD-3H Watkins Johnson M1B
Distortion Analyzer	±3% Accuracy	Sound Technology 1700A
Wave Analyzer	Min. BW≤ 1000 Hz Amplitude Accuracy of ±1 dB Range: 1 MHz	HP310A
GR874 Tee		GR874-TL
Wideband RF Voltmeter	RMS Voltage Sensitivity: 100 μV Frequency Range: 10 kHz-11 MHz	JF 8920A
10 dB Attenuator (2)		GR874-G10L
20 dB Attenuator (2)	Mark one, #1; the other #2	GR874-G20L

NOTE: 1) Must be purchased after 11/1/77 or DC resistance equal to 50Ω ± 0.1%.
2) Optional equipment for attenuator response verification.

4-9. Cleaning

4-10. Clean the instrument periodically to remove dust, grease, and other contamination. Use the following procedure:

1. Clean the interior with clean, dry, low pressure air (i.e., 20 psi).

2. Should the circuit boards require cleaning, spray them with Freon TF Degreaser MS180 (Miller-Stephenson Chemical Co.) and then remove the dirt with clean, dry, low pressure air.

3. Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or a soft cloth dampened in a mild solution of detergent and water.

4-11. Circuit Board Sealant

WARNING

TO PREVENT PERSONNEL OR INSTRUMENT DAMAGE WHEN WORKING WITH TOLUOL, FOLLOW THESE PRECAUTIONS: USE ONLY IN WELL VENTILATED SPACES, AVOID INHALING THE VAPORS, AVOID EXCESSIVE CONTACT WITH THE SKIN, KEEP AWAY FROM OPEN FLAME, INSURE THAT PLASTIC COMPONENTS DO NOT COME IN CONTACT WITH THE TOLUOL (TOLUOL IS A PLASTIC SOLVENT).

4-12. When soldering to a printed circuit land, the heat from the soldering iron will decompose the epocast (a polyurethane resin coating used to inhibit fungus growth and moisture absorption). Upon completion of soldering, remove this char residue with a solvent such as toluol. Then coat the cleared area with a sealant such as Circuit Coat (Furance Plastics, Inc., 4516 Brazil St., Los Angeles, California, or 16 Speiling Road, Fairfield, New Jersey). If it is necessary to clean the component side of the board, refer to the Cleaning procedure above.

4-13. Fuse Replacement

4-14. Insure that line power fuse (F1) is the following value:

115V operation	Type MDL, 1 amp., slow blow
230V operation	Type MDL, 1/2 amp., slow blow

4-15. PERFORMANCE CHECKS

4-16. Introduction

4-17. Use the performance checks as an initial acceptance test and as semi-annual calibration checks. These checks can be performed with the instrument covers on. If an out of specification result is obtained, perform the first level calibration adjustments or troubleshoot and repair as indicated.

4-18. Local Programming Check

4-19. Use the following procedure to check local programming:

1. Connect the TTL output of the UUT to the A channel input of the counter through an external 50Ω termination.

2. Connect the 10 Hz - 11 MHz output of the UUT to the input of the True RMS Voltmeter.

3. Verify the Memory functions as follows:

   a. Program and store various frequencies and levels in memory locations 1 through 9.

   b. Recall the memory locations one at a time.

   c. Use the test equipment to verify proper frequency and level at each memory location.

4. Verify the Edit functions as follows:

   a. Program the UUT for an output of 9.99999 MHz at a level of 5V rms, TERM.

   b. Rotate the DECADE control to verify that each display location can be selected (digit brightens).

   c. Rotate the DIGIT control at each display digit location and verify that the digit is incremented or decremented by one for each detent change of the DIGIT control. Verify proper operation for the carry and borrow functions also.

NOTE

The Edit controls can be rotated faster than the unit can sense. Rotate at a moderate speed.

   d. Program STEP SIZE of 2 through 9 and rotate the DECADE and DIGIT controls to verify proper change in increment or decrement size for each display digit position.

5. Verify the REFERENCE functions as follows:

a. Program the UUT for a REFERENCE FREQUENCY of 1 MHz and a REFERENCE LEVEL of 5V rms, OPEN.

b. Program +100 kHz and +1V.

c. The counter should indicate 1100 kHz and the RMS Voltmeter should indicate 6V.

d. Program -100 kHz and -1V.

e. The counter should indicate 900 kHz and the RMS Voltmeter should indicate 4V.

f. Press the REFERENCE FREQ and REFERENCE LEVEL controls. The REFERENCE FREQ and REFERENCE LEVEL indicators should extinguish.

6. Verify the LEVEL LIMIT function as follows:

a. Program the UUT for an output of 10 kHz at 1V, TERM.

b. Store the 1V as LEVEL LIMIT. The level display should remain 1.000V.

c. Program 50 mV rms as REFERENCE LEVEL. The level display should read all zeros.

d. Verify that the RMS Voltmeter reads 50 mV.

e. Program 40 dB. The level display should read a flashing +40.00 dB to indicate that the programmed level exceeds the programmed LEVEL LIMIT.

f. The RMS Voltmeter should still indicate 50 mV.

g. Press the LEVEL LIMIT control to remove level limiting. The LEVEL LIMIT indicator should extinguish.

h. The level display should read a steady +40.00 dB.

i. The RMS Voltmeter should indicate 5V.

j. Press the REFERENCE LEVEL control.

7. Verify the OUTPUT functions as follows:

a. Program the UUT for an output of 10 kHz at 2V rms, TERM.

b. The RMS Voltmeter should indicate 4 ±.04V rms.

c. Press the OPEN/TERM control. The OPEN indicator should illuminate and the TERM indicator should extinguish.

d. The RMS Voltmeter should indicate 2 ±.02V rms.

e. Press the Vp-p/Vrms control. The Vp-p indicator should illuminate the Vrms indicator should extinguish.

f. The RMS Voltmeter should indicate 1.414 ±.014V rms.

4-20. AMPLITUDE D/A OPERATION CHECK

4-21. Use the following procedure to check the operation of the d/a converter on the D/A Amplitude PCB. This check verifies the function, not the accuracy of each control bit.

1. Connect the RMS Voltmeter to the 10 Hz-11 MHz output of the UUT without a termination. Change range and zero the RMS Voltmeter as necessary.

2. Set the RMS Voltmeter controls to 10V range, TVM mode.

3. Program the UUT for an output of 10 kHz at 9.999V rms, OPEN, AM on.

4. Rotate the DECADE control until the volts digit is bright.

5. Rotate the DIGIT control counterclockwise (ccw) so that the level display decrements from 9.999V to 0.999V in 1V steps.

6. Verify a 1V decrease in the RMS Voltmeter indication per step.

7. Rotate the DIGIT control clockwise (cw) so that the level display increments from 0.999V to 9.999V in 1V steps.

8. Verify a 1V increase in the RMS Voltmeter indication per step.

9. Null the RMS Voltmeter on the 10% range.

10. Rotate the DECADE control one detent position clockwise (cw). The tenths volts position should be brighter.

11. Rotate the DIGIT control counterclockwise (ccw) so that the level display changes from 9.999V in 0.1V steps.

12. Verify a 1% decrease in the RMS Voltmeter indication per step.

13. Rotate the DIGIT controls clockwise (cw) so that the level display changes from 9.099V to 9.999V in 0.1V steps.

14. Verify a 1% increase in the RMS Voltmeter indication per step.

15. Null the RMS Voltmeter on the 0.1% range.

16. Rotate the DECADE control on detent position clockwise (cw). The hundredths position should be brighter.

17. Rotate the DIGIT control counterclockwise (ccw) so that the level display changes from 9.999V to 9.909V in 0.01V steps.

18. Verify a 0.1% decrease in the RMS Voltmeter display per step.

19. Rotate the DIGIT control clockwise (cw) so that the level display changes from 9.909V to 9.999V in 0.01V steps.

20. Verify a 0.1% increase in the RMS Voltmeter display per step.

21. Null the RMS Voltmeter on the 0.01% range.

22. Rotate the DECADE control one detent position clockwise (cw). The millivolt position should be brighter.

NOTE

Significant errors may occur during the remainder of this procedure. As long as the output level changes uniformly for each edit step, the UUT is functioning properly.

23. Rotate the DIGIT control counterclockwise (ccw) so that the level display changes from 9.999V to 9.990V in 1 mV steps.

24. Verify a 0.01% decrease in the RMS Voltmeter indication per step.

25. Rotate the DIGIT control clockwise (cw) so that the level display changes from 9.990V to 9.999V in 1 mV steps.

26. Verify a 0.01% increase in the RMS Voltmeter indication per step.

4-22. Output Level Accuracy Check

4-23. Use the following procedure to check the instrument output accuracy.

1. Connect the precision 50 ohm termination (GR-874), Tee, and adapter directly to the 10 Hz - 11 MHz output of the UUT.

2. Connect the RMS Voltmeter to the termination through the GR-874 Tee with less than 61 cm (24″) of RG58 coaxial cable.

3. Program the UUT for an output of 10 kHz at 5V rms, TERM.

4. Null the RMS Voltmeter on 0.1% range. The RMS Voltmeter should indicate between 4.971 and 5.02V rms.

5. Sequentially program the UUT for output levels in Table 4-2, Output Level Accuracy.

6. Use the RMS Voltmeter to verify that the output level is within the specifications listed in Table 4-2, at a 0.1% null on the RMS Voltmeter.

4-24. Full Output Frequency Response Check

4-25. Use the following procedure to check the frequency response of the UUT when programmed for full output.

1. Connect the equipment as shown in Figure 4-1, Full Output Frequency Response Check.

NOTE

Use a support so that the GR 874 may be connected directly to the 10 Hz-11 MHz output. Position the thermal converter in as stable a thermal environment as possible.

2. Program the UUT for an output of 10 kHz at 26.9 dB.

3. Set the DVM range control to 10 mV, Vdc.

4. Let the reading stabilize then record it.

5. Store 26.9 dB as REFERENCE LEVEL for the UUT.

6. Program the UUT for an output of 10.99999 MHz.

7. Rotate the decade control until the least significant digit of the level display is bright.

8. Rotate the DIGIT control until the DVM indicates the same reading as recorded in step 4 of this procedure. (It may be necessary to interpolate between two digits on the UUT.)

9. The UUT level display indicates the correction for frequency response. Mentally reverse the sign to obtain the frequency response error at 10.99999 MHz.

10. As indicated in Table 4-3, Model 6011A Frequency Response Tolerances at full output, the frequency response error at 10.99999 Mhz should not exceed ±0.05 dB.

11. Repeat steps 6 through 10 for each frequency listed in Table 4-3.

12. Verify that the UUT frequency response errors are within the tolerances listed in Table 4-3. The 10 kHz frequency at the end of the table is a check of the stability of the thermal converter.

Table 4-2. Output Level Accuracy

OUTPUT LEVEL	ATTENUATOR RANGE	ALLOWABLE ΔP		READING LIMITS		
		dB	%	HIGH	NORMAL	LOW
4.378V	0 dB	±.05 dB	±.58%	4.403	4.378	4.353 Vrms
2.378V	0 dB	±.065 dB	±.75%	2.396	2.378	2.360 Vrms
1.378V	0 dB	±.075 dB	±.87%	1.390	1.378	1.366 Vrms
23.01 dB	0 dB	±.06 dB	±.69%	3.184	3.162	3.140 Vrms
3.01 dB	−20 dB	±.1 dB	±1.16%	319.9	316.2	312.6 mV rms
−16.99 dB	−40 dB	±.12 dB	±1.39%	32.06	31.62	31.19 mV rms
−36.99 dB	−20 & −40 dB	±.13 dB	±1.51%	3.210	3.162	3.115 mV rms
13.01 dB	−10 dB	±.08 dB	±.92%	1.009	1.000	.991 Vrms
−6.99 dB	−10 & −20 dB	±.11 dB	±1.27%	.1013	.1000	.987 Vrms
−26.99 dB	−10 & −40 dB	±.13 dB	±1.51%	10.15	10.00	9.85 mV rms
−46.99 dB	−10 & −20 & −40 dB	±.14 dB	±1.62%	1.016	1.000	.984 mV rms

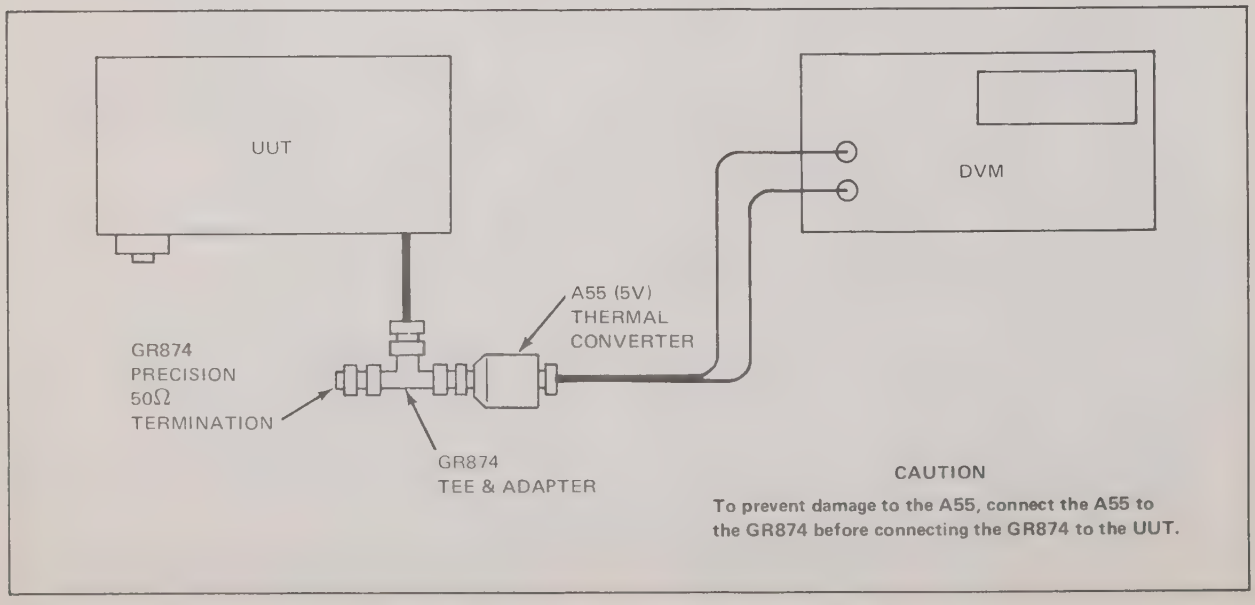


Figure 4-1. Full Output Frquency Response Check

Table 4-3. Full Output Frequency Response

FREQUENCY	TOLERANCE
10.99999 MHz	±.05 dB
7.0 MHz	±.035 dB
5.0 MHz	±.025 dB
1.0 MHz	±.025 dB
100 kHz	±.025 dB
100 Hz	±.025 dB
20 Hz	+.05 dB to −.025 dB
10 Hz	+.2 dB to −.025 dB
10 kHz	Reference

4-26. Model 6011A Attenuator Frequency Response Check

4-27. The frequency response of the Model 6011A has been verified at full output level and the accuracy of the attenuator has been verified at 10 kHz by previous check. If the attenuator has not been repaired or replaced, the frequency response of the attenuator may be assumed to be within specifications with a confidence level of approximately 90%. If this is satisfactory, proceed to the Spectral Purity and Distortion Check. If this is not satisfactory, continue with this check.

4-28. The attenuator frequency response check tests the frequency response of each attenuator section separately, and the response of any two sections connected together. The confidence level is approximately 98%. This check is optional.

4-29. This procedure will provide computations of errors in the Model 6011A and errors in the external detector and attenuators that are used for this check. These % errors will determine whether the attenuator section of the Model 6011A Attenuator PCB is within specifications and provide a permanent record of performance of the Model 6011A attenuators and external test equipment.

4-30. The Model 6011A Attenuator Frequency Response Check is divided into four parts. Part one determines attenuator performance at low frequencies. Part two determines the frequency response of the external detector for the high frequencies. Part three determines the frequency response of the individual external attenuators for high frequencies. Part four determines the frequency response of the Model 6011A at various levels of attenuation. Figure 4-2, Attenuator Frequency Response Datasheet will be used to record all the errors determined during this check. Make a new copy of the blank data sheet and Figure 4-3, Attenuator Frequency Response Worksheet each time this check is performed and the completed data sheet will provide a permanent record of instrument attenuator, and test equipment performance.

4-31. To determine the low frequency response of the Model 6011A, proceed as follows:

1. Use Section A of the data sheet to record the data from this part of the check.

2. Connect the precision 50Ω termination, Tee and adapter (GR 874) directly to the 10 Hz to 11 MHz output of the Model 6011A.

3. Connect the Model 931B to the adapter with less than 58 cm (24″) of coaxial cable.

4. Program 10 kHz and 2.5V rms, TERM.

5. Store the 2.5V rms as Reference Level.

6. Program −10 dB. Adjust the Model 931B for a null on the 1% range (.79V).

7. Program the frequencies listed and record the meter readings.

8. Repeat steps 6 and 7 for each attenuation.

4-32. To determine the frequency response of the external detector, proceed as follows:

NOTE

The external detector consists of the Fluke 8920A, the 50Ω termination and the 10 dB pad. The frequency response is determined at .25V to calibrate the individual attenuator sections in the next procedure.

1. Connect the equipment as shown in Figure 4-4, External Detector Frequency Response Check.

2. Program 10 kHz and a reference level of 0.25V rms, TERM. Allow sufficient time for the A55 thermal converter to reach thermal equilibrium.

3. Record the readings on both DVMs in the appropriate blank in step 1 of the Attenuator Frequency Response Worksheet, Figure 4-3.

4. Program 100 kHz and edit the Model 6011A level until the reading on DVM 1 matches the reading of DVM #1 recorded on the Worksheet, step 1.

5. Depress the ACTUAL switch and note the Level Display.

6. Store this level as Reference Level.

7. Edit the Model 6011A level until the reading on DVM #2 matches the reading of DVM #2 recorded on the Worksheet, step 1.

8. The Model 6011A Level Display is now the correction, in volts, of the external detector as referenced to 10 kHz.

9. Record this correction in the appropriate blank on the Worksheet, step 2. Perform the indicated operations and record the % of error in the appropriate blank in Section B of the Datasheet.

10. Store a Reference Level of 0.25V rms.

11. Repeat steps 4 through 10 of this procedure for each frequency indicated in Section B of the Datasheet.

4-33. To determine the frequency response of the individual standard attenuator sections proceed as follows:

WARNING

WHEN DIRECTED TO CHANGE EQUIPMENT CONNECTIONS, DISCONNECT THE A55, MAKE THE CHANGES, THEN RECONNECT THE A55. FAILURE TO FOLLOW THIS PROCEDURE WILL RESULT IN DAMAGE TO THE A55.

1. Connect the equipment as shown in Figure 4-5, Standard Attenuator Frequency Response Determination.

2. Place a 20 dB attenuator in the Attenuator under test position and use a 5V A55.

3. Program the Model 6011A for an output of 10 kHz and a reference level of 2.5V rms.

4. Record the readings of both DVMs in the appropriate blank on the Worksheet, step 3.

5. Program the Model 6011A for an output of 100 kHz.

6. Edit the Model 6011A level until the reading on DVM #1 matches the reading of DVM #1 recorded on the Worksheet, step 3.

7. Depress the ACTUAL switch and note the Level Display.

8. Store this level as Reference Level.

9. Edit the Model 6011A level until DVM #2 reads the same as the value for DVM #2 recorded on the Worksheet, step 3.

10. The level displayed is the correction, in volts, of the external standard attenuator as referenced to 10 kHz.

11. Record in the appropriate blank on the Worksheet, step 4.

12. Perform the indicated computations on the correction and record the % of error in the appropriate frequency on the Datasheet, Section B, line 3.

13. Repeat steps 5 through 12 for each frequency in Section B of the Datasheet.

14. Remove the first 20 dB attenuator and install the second 20 dB attenuator in its place.

15. Repeat steps 3 through 13 for the second 20 dB attenuator and record the % of error values obtained on the Datasheet, Section B, line 4.

16. Replace the 20 dB attenuator with the 10 dB attenuator.

17. Replace the 5V A55 with a 0.5V A55.

18. Program the Model 6011A for 10 kHz, 0.5V, TERM.

19. Repeat steps 4 through 13 using the "10 dB computation" on the Worksheet, step 4, to compute the % of error and the Datasheet, Section B, line 2, to record the % of error.

4-34. To determine the % of error of the Model 6011A at 2.5V, TERM., proceed as follows:

1. Connect the equipment as shown in Figure 4-6, Model 6011A Frequency Response Determination.

2. Program the Model 6011A for an output of 10 kHz at 2.5V, TERM.

3. Record the detector reading in all the blanks on the Worksheet, step 5, line 2.

4. Program the Model 6011A for 100 kHz. (Level should remain at 2.5V TERM throughout this procedure.)

5. Record the detector reading in the appropriate blank on the Worksheet, step 5, line 1.

6. Repeat steps 4 and 5 for each frequency indicated on the Worksheet, step 4.

7. Record the appropriate information from the Datasheet, Section B, lines 1 and 3 on the Worksheet,step 5 , lines 6 and 8.

8. Perform the operations indicated on the Worksheet, step 5, and record the results on the Datasheet, Section B, line 5.

9. Verify that the errors are less than listed tolerances.

SECTION "A"

FREQUENCY	6011A TOLERANCE	–10 dB (.79V)	–20 dB (.25V)	–30 dB (79 mV)	–40 dB (25 mV)	–50 dB (7.9 mV)
100 Hz	±.29					
20 Hz	+.58 or –.29					
10 Hz	+2.3 or –.29					

SECTION "B"

LINE	FREQUENCY	10 kHz	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
1	% Error External Detector						
2	% Error 10 dB External Attenuator						
3	% Error #1 20 dB External Attenuator						
4	% Error #2 20 dB External Attenuator						
5	% 6011A Error @ 2.5V						
6	% Additional Error @ –10 dB						
7	% Additional Error @ –20 dB						
8	% Additional Error @ –30 dB						
9	% Additional Error @ –40 dB						
10	% Additional Error @ –50 dB						
11	% Total Error @ –10 dB						
12	% Total Error @ –20 dB						
13	% Total Error @ –30 dB						
14	% Total Error @ –40 dB						
15	% Total Error @ –50 dB						

TOLERANCES

10 kHz	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
±.29%	±.29%	±.29%	±.29%	±.29%	±.58%
±.29%	±.44%	±.51%	±.73%	±.85%	

NOTE: All measurements are referenced to levels established at 10 kHz.

Figure 4-2. Attenuator Frequency Response Datasheet

1. _____ :DVM #1 _____ :DVM #2

2. C = _____

1) $100\left(\frac{\text{correction}}{\text{level}}\right) = 100\left(\frac{c}{0.25V}\right) = \frac{400c}{1V}$

2) Reverse the sign

3. _____ :DVM #1 _____ :DVM #2

4. C =

	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
#1 20 dB Attenuator					
#2 20 dB Attenuator					
10 dB Attenuator					

20 dB Computations

1) $100\left(\frac{\text{correction}}{\text{level}}\right) = 100\left(\frac{c}{2.5V}\right) = \frac{40c}{1V}$

2) Reverse the sign

3) Subtract the detector error. (Datasheet, Section B, line 1.)

10 dB Computations

1) $100\left(\frac{\text{correction}}{\text{level}}\right) = 100\left(\frac{c}{0.5V}\right) = \frac{200c}{1V}$

2) Reverse the sign

3) Subtract the detector error. (Datasheet, Section B, line 1.)

5.

LINE	INSTRUCTION	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
1	Detector Reading					
2	Detector Reading @ 10 kHz					
3	Line 1 – Line 2					
4	Line 3 ÷ Line 2					
5	Line 4 X 100					
6	External Detector % Error					
7	Line 5 – Line 6					
8	#1 20 dB Attenuator % error					
9	Line 7 – Line 8					

6.

LINE	INSTRUCTION	10 kHz	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
1	Detector Readings @ 2.5V						
2	Detector Readings @ –10 dB						
3	Line 2 – Line 1						
4	Line 3 ÷ Line 1						
5	100 X Line 4						
6	% error of 10 dB Attenuator						
7	Line 5 – Line 6						
8	Detector Readings @ –20 dB						
9	Line 8 – Line 1						
10	Line 9 ÷ Line 1						
11	100 X Line 10						
12	% error of #1 20 dB Attenuator						
13	Line 11 – Line 12						
14	Detector Readings @ –30 dB						
15	Line 14 – Line 1						

Figure 4-3. Attenuator Frequency Response Worksheet

LINE	INSTRUCTION	100 kHz	1 MHz	2 MHz	7 MHz	10.99999 MHz
16	Line 15 ÷ Line 1					
17	100 X Line 16					
18	% error of #1 20 dB Attenuator					
19	Line 17 – Line 18					
20	% error of 10 dB Attenuator					
21	Line 19 – Line 20					
22	Detector Readings @ –40 dB					
23	Line 22 – Line 1					
24	Line 23 ÷ Line 1					
25	100 X Line 24					
26	% error of #1 20 dB Attenuator					
27	Line 25 – Line 26					
28	% error of #2 20 dB Attenuator					
29	Line 27 – Line 28					
30	Detector Readings @ –50 dB					
31	Line 30 – Line 1					
32	Line 31 ÷ Line 1					
33	100 X Line 32					
34	% error of 10 dB Attenuator					
35	Line 33 – Line 34					
36	% Error of #1 20 dB Attenuator					
37	Line 35 – Line 36					
38	% Error of #2 20 dB Attenuator					
39	Line 37 – Line 38					

Figure 4-3. Attenuator Frequency Response Worksheet (cont)

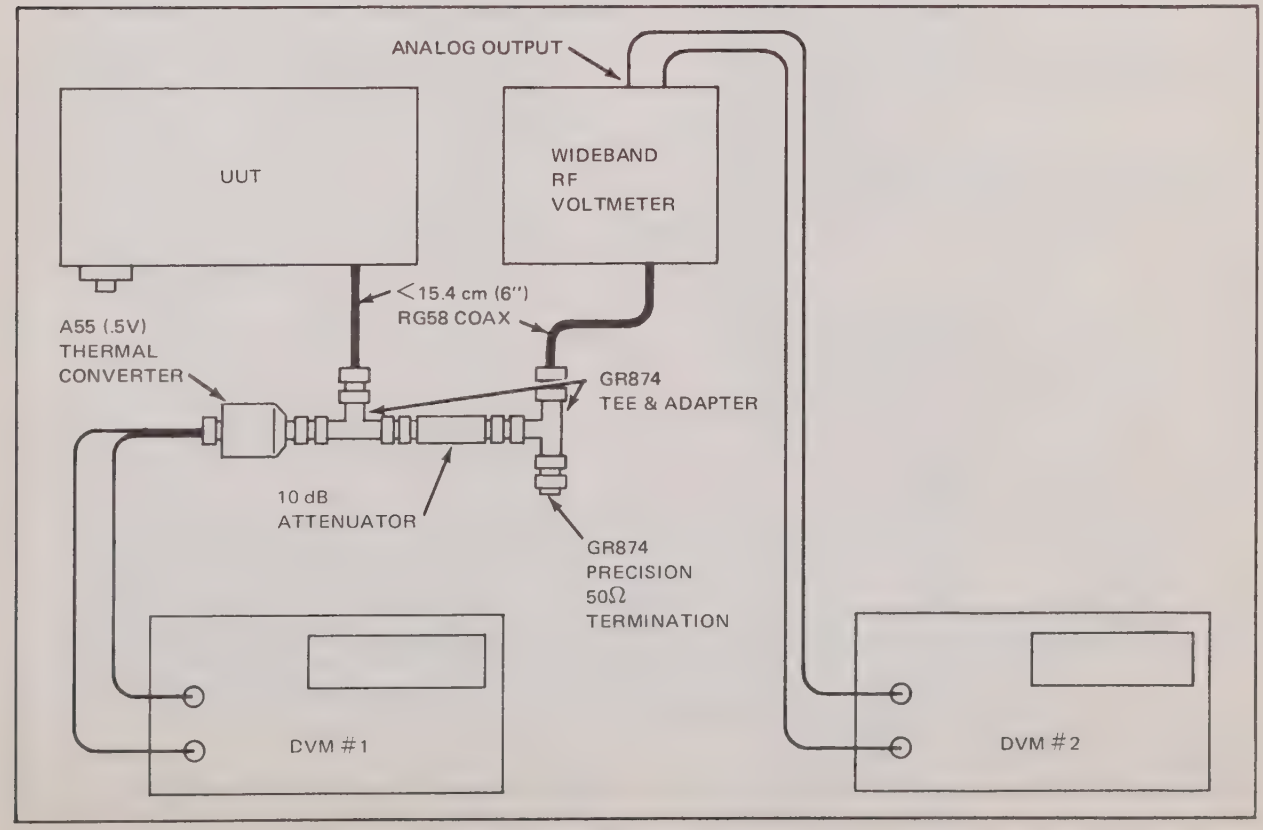


Figure 4-4. External Detector Frequency Response Determination

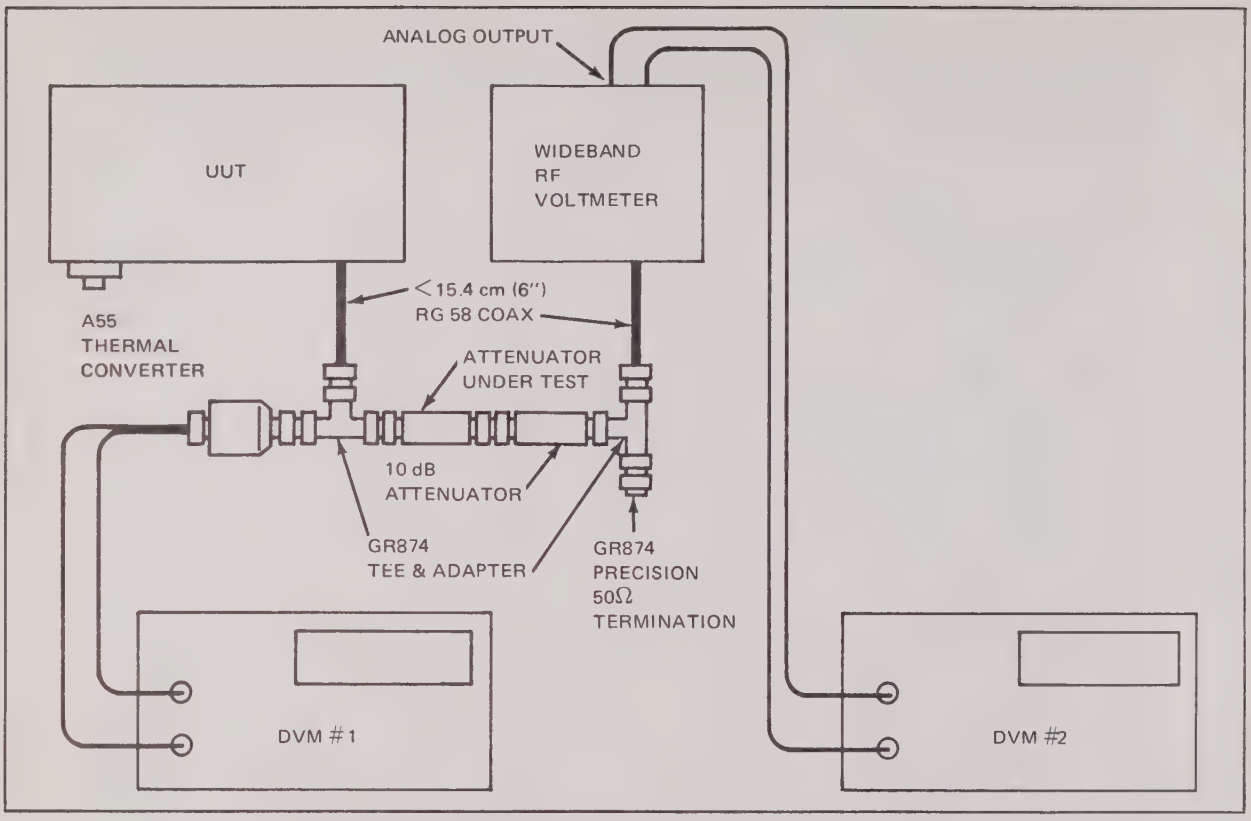


Figure 4-5. Standard Attenuator Frequency Response Determination

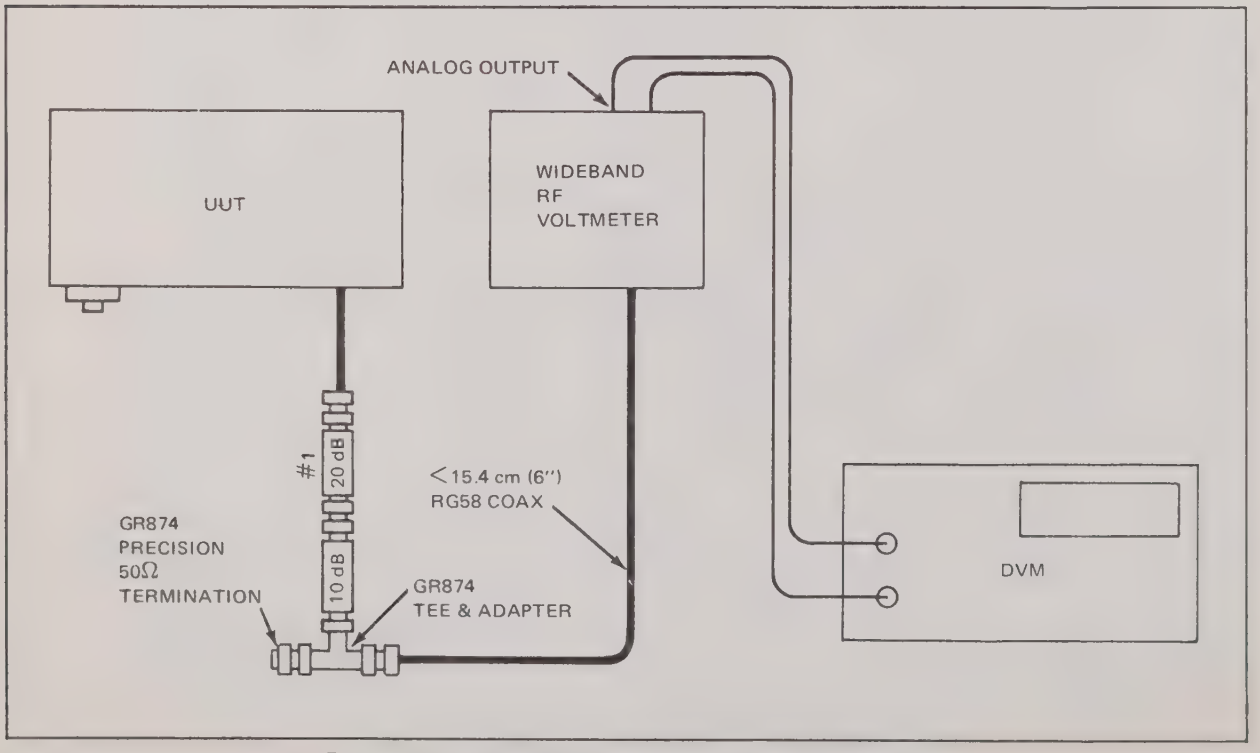


Figure 4-6. Model 6011A Frequency Response Determination

4-35. To determine the total % of error of the Model 6011A at –10 dB through –50 dB (each attenuator section of the Model 6011A is checked), proceed as follows:

1. Connect the equipment as shown in Figure 4-6, Model 6011A Frequency Response Determination. Replace the 20 dB attenuator with the 10 dB and both 20 dB attenuators.

2. Program the Model 6011A for an output of 10 kHz at 2.5V, TERM.

3. Record the detector reading in the appropriate blank on the Worksheet, step 6, line 1.

4. Without changing the level, program each frequency in step 6 of the Worksheet and record the detector readings in the appropriate blanks on the Worksheet, step 6, line 1.

5. Program the Model 6011A for 10 kHz and Reference Level of 0.79V (–10 dB).

6. Remove the 10 dB attenuator.

7. Edit the Model 6011A until the detector reads the same as on the Worksheet, step 6, line 1, 10 kHz column.

8. Program each of the remaining frequencies in step 6 of the Worksheet and record the detector readings at the frequencies in the appropriate blanks on the Worksheet, step 6, line 2.

9. Perform the Instructions on the Worksheet, step 6, lines 3 through 7.

10. Record the data from the Worksheet, step 6, line 7, on the Datasheet, Section B, line 6.

11. Replace the 10 dB attenuator and remove 20 dB attenuator #1.

12. Program the Model 6011A for 10 kHz and a Reference Level of 0.25V, (–20 dB) TERM.

13. Edit the Model 6011A until the detector reads the same as on the Worksheet, step 6, line 1, 10 kHz column.

14. Program each of the remaining frequencies in step 6 of the Worksheet and record the detector readings at the frequencies in the appropriate blanks on the Worksheet, step 6, line 8.

15. Perform the Instructions on the Worksheet, step 6, lines 9 through 13.

16. Record the data from the Worksheet, step 6, line 13, on the Datasheet, Section B, line 7.

17. Remove the 10 dB attenuator.

18. Program the Model 6011A for 10 kHz and Reference Level of 79 mV (–30 dB) TERM.

19. Edit the Model 6011A until the detector reads the same as on the Worksheet, step 6, line 1, 10 kHz column.

20. Program the remaining frequencies of step 6 on the Worksheet and record the detector readings in the appropriate blanks on the Worksheet, step 6, line 14.

21. Perform the Instructions on the Worksheet, step 6, lines 15 through 21.

22. Record the data from the Worksheet, step 6, line 21, on the Datasheet, Section B, line 8.

23. Remove the other 20 dB attenuator and place the 10 dB attenuator back in the circuit. (At this time, only the 10 dB attenuator should be in the circuit.)

24. Program the Model 6011A for 10 kHz and Reference Level of 25 mV (–40 dB) TERM.

25. Edit the Model 6011A level until the detector reads the same as on the Worksheet, step 6, line 1, 10 kHz column.

26. Program the remaining frequencies of step 6 on the Worksheet and record the detector readings in the appropriate blanks on the Worksheet, step 6, line 22.

27. Perform the Instructions on the Worksheet, step 6, lines 23 through 29.

28. Record the data from the Worksheet, step 6, line 29, on the Datasheet, Section B, line 9.

29. Remove the 10 dB attenuator from the circuit.

30. Program the Model 6011A for 10 kHz and a Reference Level of 7.9 mV (–50 dB), TERM.

31. Edit the Model 6011A until the detector reads the same as on the Worksheet, step 6, line 1, 10 kHz column.

32. Program the remaining frequencies of step 6 on the Worksheet and record the detector readings in the appropriate blanks on the Worksheet, step 6, line 30.

33. Perform the Instructions on the Worksheet, step 6, lines 31 through 39.

34. Record the data from the Worksheet, step 6, line 39, on the Datasheet, Section B, line 10.

35. To obtain the total errors of the Model 6011A, on the Datasheet, Section B:

a. Add line 6 to line 5 and record the sum in line 11.

b. Add line 7 to line 5 and record the sum in line 12.

c. Add line 8 to line 5 and record the sum in line 13.

d. Add line 9 to line 5 and record the sum in line 14.

e. Add line 10 to line 5 and record the sum in line 15.

36. Lines 11 through 15 of the Datasheet, Section B, are the total % of error of the UUT at various levels of attenuation. Verify that these errors are within the tolerances listed immediately to the right of the % of errors.

4-36. Spectral Purity and Distortion Check

4-37. Use the following procedure to check the spectral characteristics and distortion of the UUT.

1. Connect the spectrum analyzer to the 10 Hz - 11 MHz output of the UUT through a 20 dB attenuator (to protect the spectrum analyzer).

2. Program the UUT for 10.99999 MHz at 5V rms, TERM.

3. On the spectrum analyzer:

a. Set the span width controls for a span width of 2 MHz/division.

b. Center the 11 MHz signal.

c. Adjust the analyzer attenuation for a reference level at 11 MHz.

NOTE

Care must be exercised in setting the spectrum analyzer controls to prevent harmonics generated within the spectrum analyzer from contaminating the harmonic measurements. Increasing the spectrum analyzer input attenuator by 10 dB should result in a 10 dB decrease in the harmonics. A change of more or less than 10 dB in the harmonics indicates harmonic distortion caused by the spectrum analyzer.

4. Adjust the spectrum analyzer tuning control from DC to 100 MHz.

5. Verify that the harmonics are greater than 35 dB down and spurious components are greater than 60 dB down from the reference level. (Probable spur locations are at 0.99999 MHz, 1.99998 MHz, and 9.00001 MHz.)

6. Set the spectrum analyzer span width control for a span width of 100 kHz/division.

7. Adjust the spectrum analyzer tuning control from 9.99999 MHz to 11.99999 MHz.

8. Verify that the spurious components are greater than 60 dB down from the reference level in this range. (Probable spur locations are at 10 MHz, 10.6 MHz, and 11.4 MHz.)

9. Program the UUT for an output level of 628 mV, AM on.

10. Verify an 18 dB drop in the 10.9999 MHz level on the spectrum analyzer.

11. Set the new level as a reference level.

12. Verify that spurious components in step 11 are greater than 60 dB down from the reference level.

13. Program the UUT for an output frequency of 2.5 MHz and adjust the analyzer to this reference level.

14. Program the UUT for an output frequency of 10 MHz.

15. Verify that all spurious components are greater than 60 dB down from the reference level.

16. Program the UUT for an output of 1 MHz at 5V, TERM.

17. Set the 1 MHz signal as the reference level on the spectrum analyzer.

18. Tune the spectrum analyzer through all harmonics of 1 MHz.

19. Verify that all harmonics are greater than 35 dB down from the reference level.

20. Connect the distortion analyzer to the UUT 10 Hz - 11 MHz output. If the analyzer does not have a 50Ω terminated input, connect it through a 50Ω termination.

21. Program the UUT for an output level of 5V, TERM.

22. Sequentially program the frequencies listed in Table 4-4, Distortion Limits.

23. Verify that the measured distortion is within the limits specified in Table 4-4.

24. Connect the wave analyzer to the UUT 10 Hz - 11 MHz output. If the analyzer does not have a 50Ω termination input, connect it through a 50Ω termination.

25. Program the UUT for an output of 109.9999 kHz at 4V, TERM.

26. Set the 109.9999 kHz signal as the reference level on the wave analyzer.

27. Verify that the 10 kHz and 90 kHz spurs are greater than 60 dB down from the reference level.

28. Program the UUT for output level at 629 mV, AM on.

29. Set this new level as full-scale reference on the wave analyzer.

30. Verify that the spurs at 31 kHz, 70 kHz, and 620 kHz are greater than 60 dB down from the reference level.

31. Program the UUT for an output frequency of 10 kHz.

32. Verify that the spurs at 200 kHz and 400 kHz are greater than 60 dB down.

Table 4-4. Distortion Limits

FREQUENCY	BAND	DISTORTION LIMITS
10 Hz	LO	3%
10 Hz	HI	3%
2 kHz	LO	.15%
2 kHz	HI	.3%
10 kHz	LO	.15%
10 kHz	HI	.3%
50 kHz	LO	.15%
50 kHz	HI	.3%
100 kHz	LO	.15%
100 kHz	HI	.3%

4-38. Phase Noise Check

4-39. Use the following procedure to check the phase noise performance of the UUT.

1. Connect the equipment as shown in Figure 4-7, Phase Noise Check.

2. Set the oscilloscope to 0.5V/div.

3. Remove the RF inputs from the mixer.

4. Adjust the dc offset of the amplifier for zero volts on the oscilloscope.

5. Reconnect the RF inputs.

6. Set the RMS Voltmeter range to 1V.

7. Set the amplifier bandwidth to 10 kHz, gain to 100.

8. Program the reference generator for an output of 10 MHz at +17 dBm.

9. Program the UUT for an output of 10.001 MHz at –40 dBm.

10. Adjust the amplifier gain for a full-scale deflection on the RMS Voltmeter.

11. Program the UUT for an output of 10 MHz at 0 dBm.

12. Rotate the DECADE control on the UUT until the least significant digit of the frequency display is bright.

13. Adjust either the reference generator frequency or the UUT TCXO until the trace stops on the oscilloscope.

NOTE

The frequencies of the two generators are exactly the same when the trace stops. When the trace is centered, the phase relationship is optimum.

14. Use the DIGIT control to center the trace. The technique is to rotate the DIGIT control one detent position, then immediately reverse the rotation to return the DIGIT control to its original position. The jump in trace indicates phase change.

15. Set the RMS Voltmeter range to 100 mV.

16. Verify that the RMS Voltmeter indicates less than 50 mV.

4-40. FIRST LEVEL CALIBRATION ADJUSTMENTS

4-41. Introduction

4-42. The first level calibration adjustments should be made to correct an out of specifications result from the semi-annual performance check. These adjustments can be performed with module covers on.

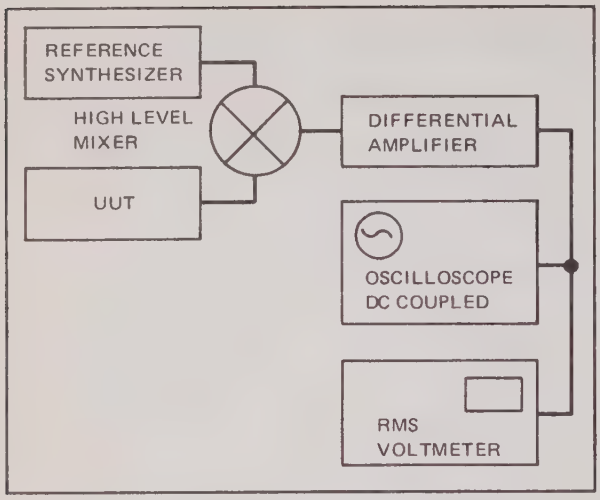


Figure 4-7. Phase Noise Check

4-43. Power Supply Adjustments

4-44. The power supply adjustments and test points are located on the Main PCB. Test points and adjustments are shown on Figure 4-8, Main PCB Test Points and Adjustments. Use the following procedure to accomplish the power supply adjustments.

1. Connect the DVM HI to J5-1, LO to chassis.

2. Adjust R14 for an indication on the DVM of −15 ±.02V.

3. Connect the DVM HI to J5-2.

4. Adjust R6 for an indication on the DVM of +14 ±.02V.

5. Connect the DVM HI to the test point listed in Table 4-5, Power Supply Test Points and Voltages.

6. Verify that the DVM indication is within the tolerances listed in Table 4-5.

4-45. Output Level Adjustments

4-46. Use the following procedure to accomplish the output level adjustments. These adjustments are located on the Input/Output PCB Module. The test points and adjustments are shown in Figure 4-9, Input/Output PCB Test Points and Adjustments.

1. Connect the DVM HI to J9-2, LO to chassis.

2. Connect the precision 50Ω termination (GR 874) to the UUT 10 Hz - 11 MHz output through the Tee.

3. Program the UUT for an output of 10 kHz at 5V rms, TERM, HI RANGE OVERRIDE.

4. Adjust R92 for an indication on the DVM of −4.7 ±.01V. This insures that the gain control loop and AM sensitivity is centered. (R92 is overall gain control.)

5. On the UUT, press the RANGE OVERRIDE control.

6. Verify that the LO range indicator illuminates.

7. Adjust R126 for an indication on the DVM of −4.7 ±.1V. (Matches LO and HI ranges.)

8. Connect the RMS voltmeter to the termination through the Tee with less than 61 cm (24″) of RG 58 coaxial cable.

9. Program the UUT for an output level of 1.255V rms.

10. Store in memory location 1.

11. Program the UUT for an output level of 1.256V rms.

12. Store in memory location 2.

13. Recall location 1.

14. Adjust the RMS voltmeter for a .1% null.

15. Record the RMS Voltmeter indication.

16. Recall location 2.

17. Increase the RMS Volmeter readout by exactly +1 mV.

18. Adjust R115 for a null on the RMS Voltmeter.

19. Repeat steps 13 through 18 until R115 requires no further adjustment.

20. Program the UUT for an output of 10 kHz at 5V rms, TERM.

21. Set the RMS Voltmeter readout to 5V.

22. Adjust R146 for a ±.02% null on the RMS Voltmeter.

23. Program the UUT for the output levels listed in Table 4-2, Output Level Accuracy.

24. Verify that the output levels indicated on the RMS Voltmeter are within the tolerances listed in Table 4-2.

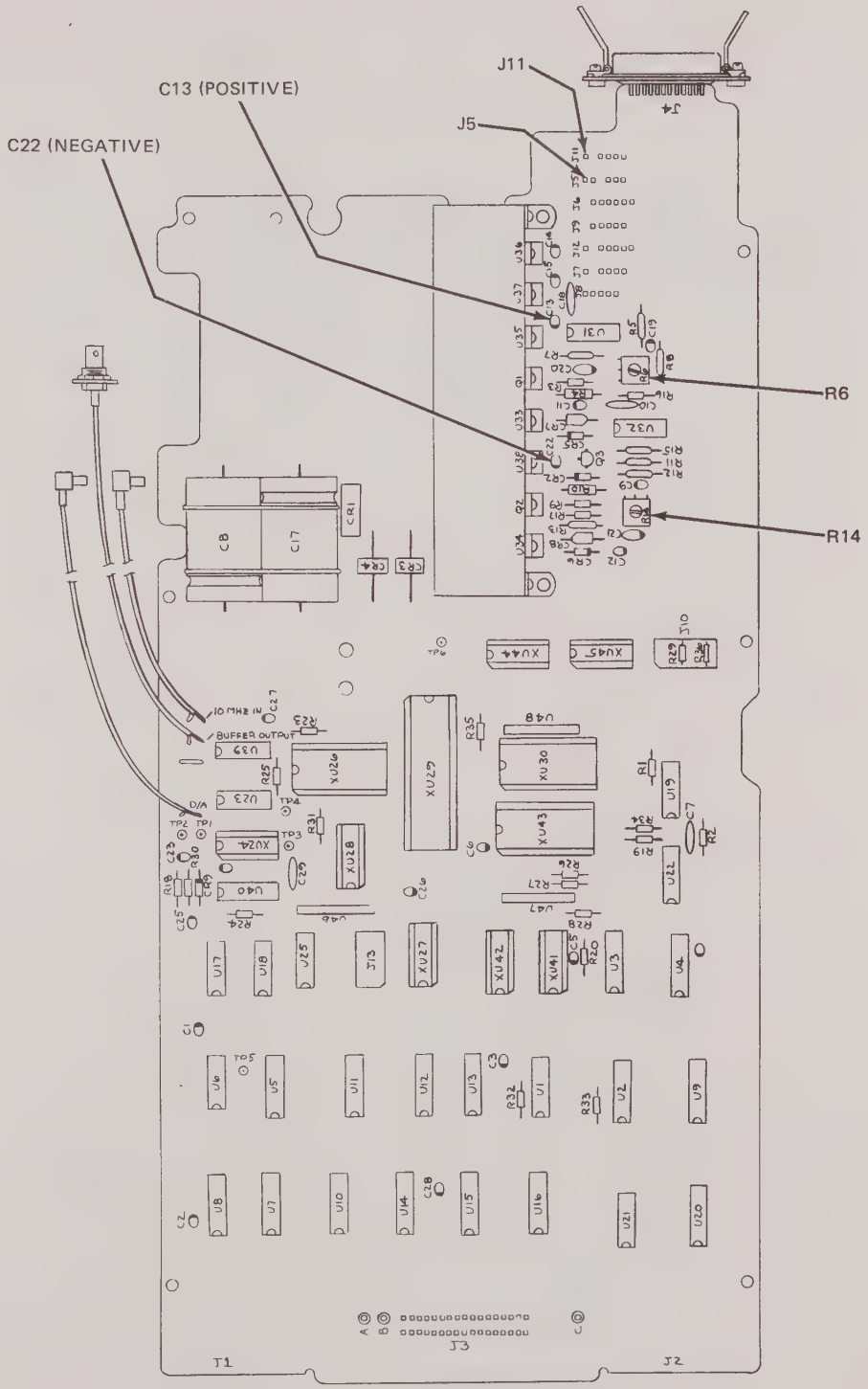


Figure 4-8. Main PCB Test Points and Adjustments

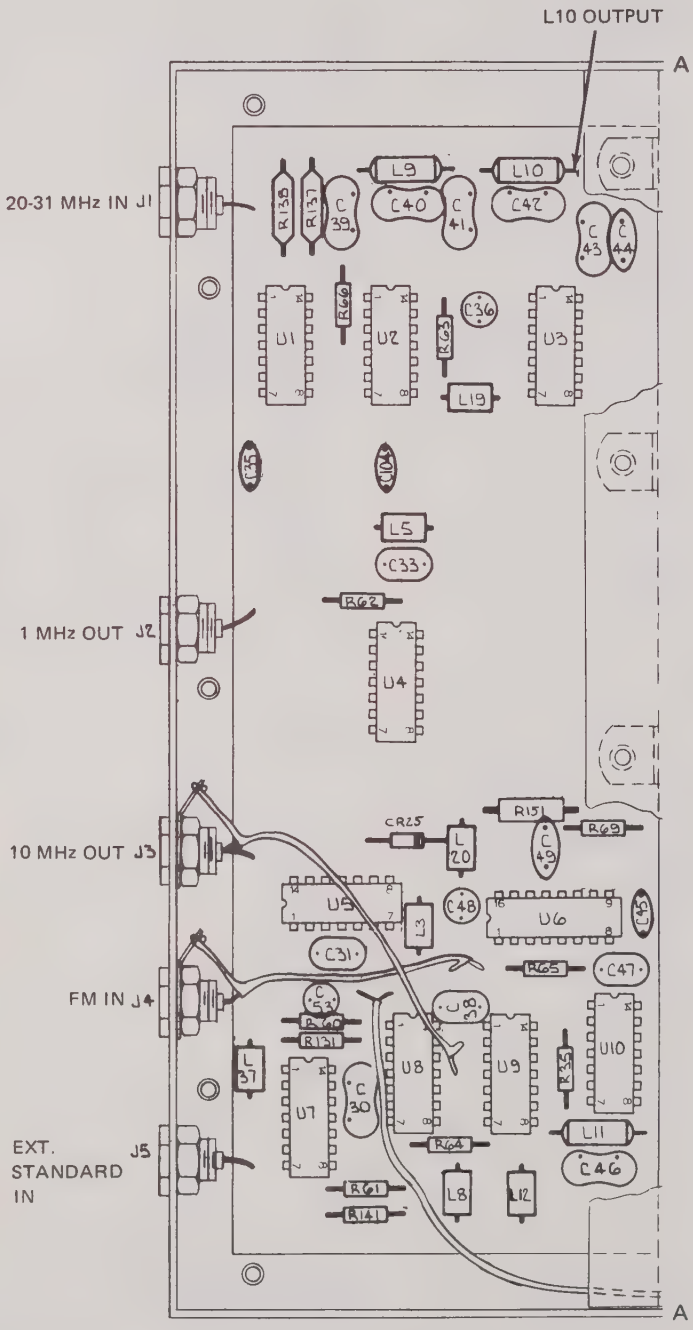


Figure 4-9. Input/Output PCB Component Location (cont)

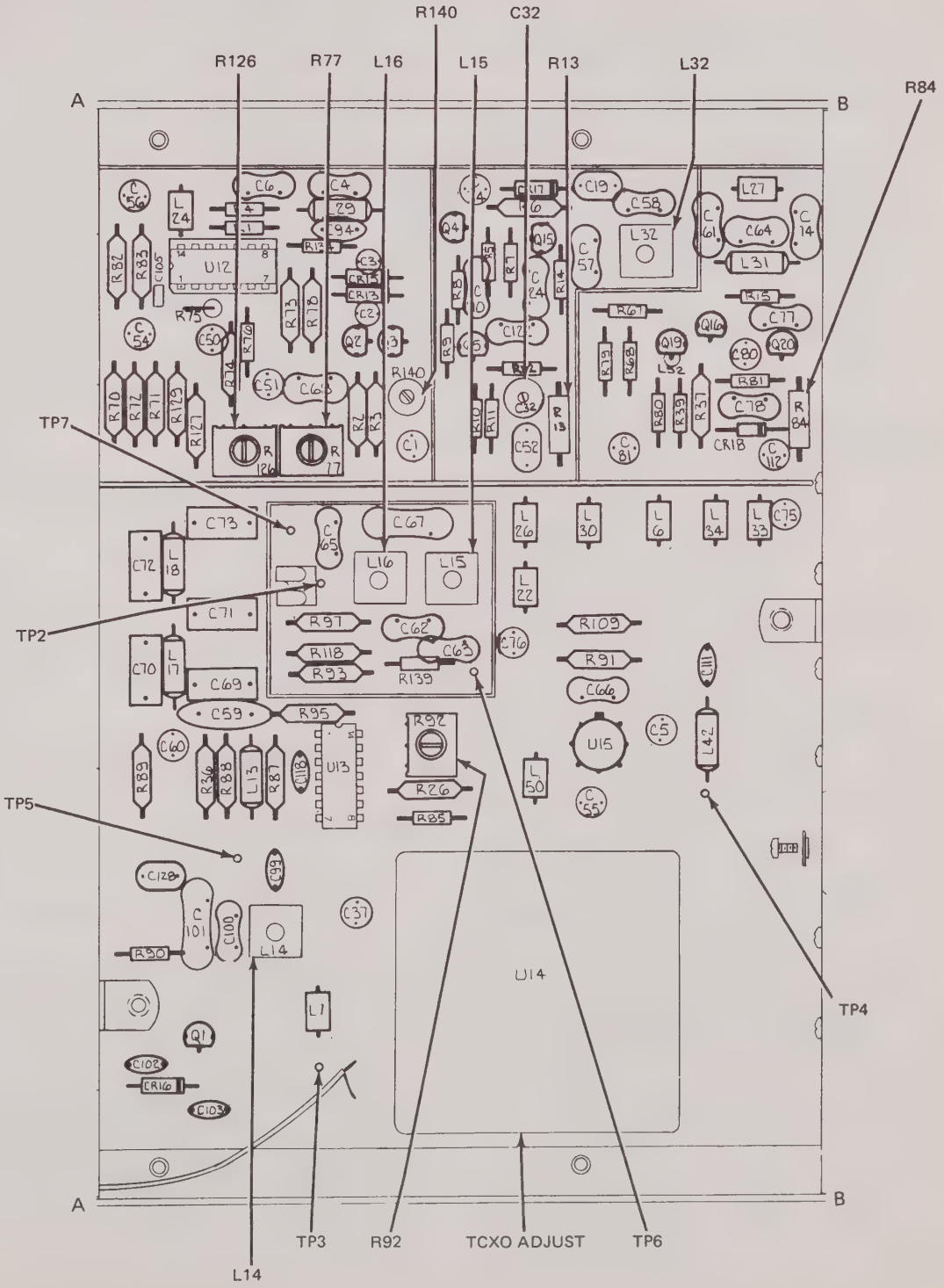


Figure 4-9. Input/Output PCB Component Location (cont)

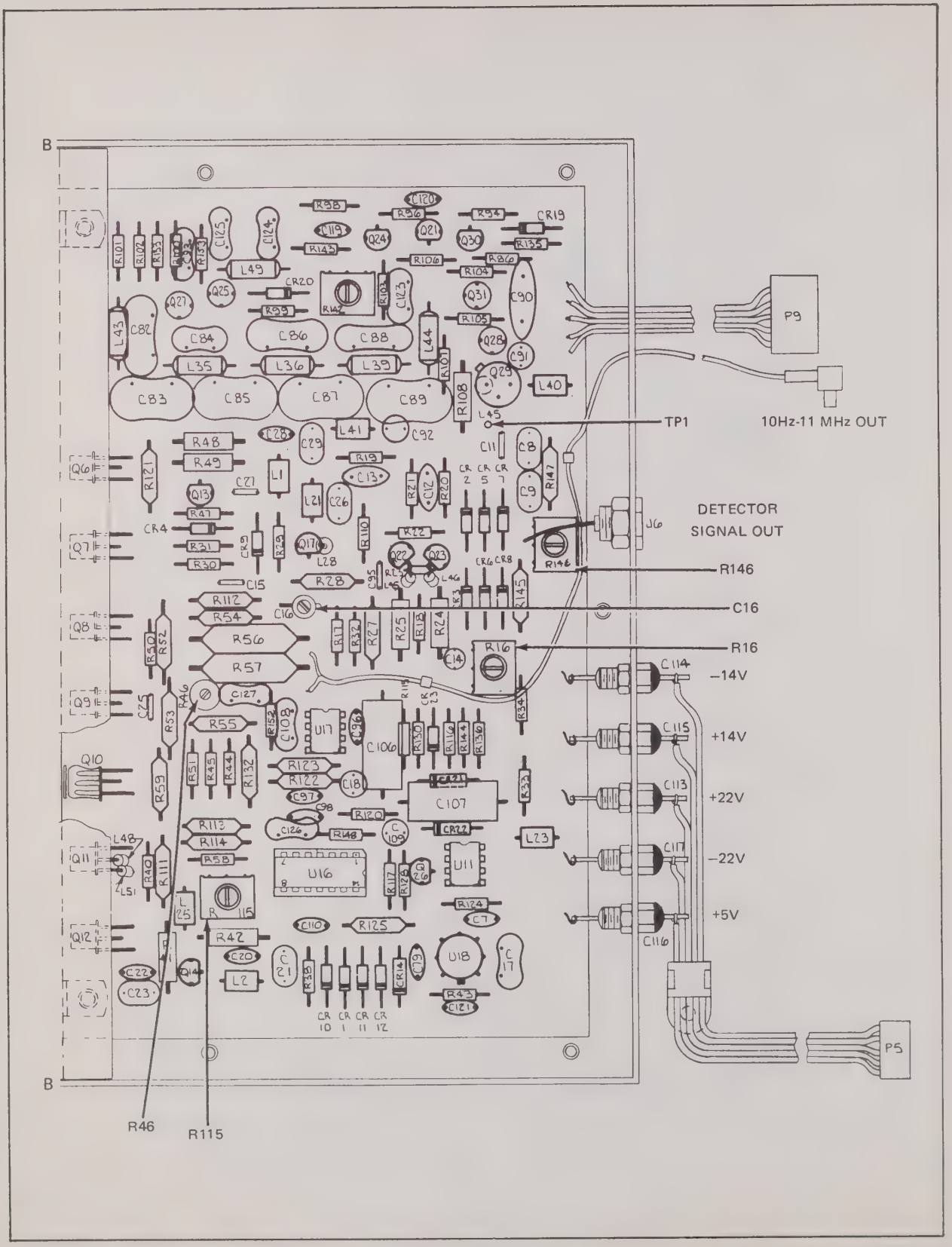


Figure 4-9. Input/Output PCB Component Location

Table 4-5. Power Supply Voltages and Test Points

TEST POINT	VOLTAGE AND TOLERANCE
J5-4	22.7 ±0.5V
J5-5	−22.7 ±0.5V
J5-6*	5.0 ±0.25V
J11-4*	5.0 ±0.25V
C13 (positive)	5.0 ±0.25V
C22 (negative)	−10.2 ±0.4V

* These are three independent 5V regulators.

4-47. TCXO Adjustments

4-48. Use the following procedure to adjust the TCXO. Figure 4-9, Input/Output PCB Test Points and Adjustments, shows the location of the TCXO adjustment.

1. Allow the instrument to warm-up at least 30 minutes before proceeding.

2. Program the UUT for an output of 10 MHz at 1V rms, TERM.

3. Connect the frequency counter to the UUT 10 Hz - 11 MHz output. If the counter does not have a 50Ω terminated input, connect it through a 50Ω termination.

4. On the UUT, adjust the TCXO for a count of 10 MHz ±1 Hz.

4-49. SECOND LEVEL CALIBRATION ADJUSTMENTS

4-50. Introduction

4-51. Perform the second level calibration adjustments if the instrument has been repaired or if the first level calibration adjustment do not bring the instrument within operating specifications.

4-52. Input/Output Module Adjustments

4-53. Use the following procedure to adjust the Input/Output Module. All test points and adjustments are shown on Figure 4-9, Input/Output PCB Test Points and Adjustments.

1. Preset C16 so that the adjustment screw protrudes 6.35 mm (.25″) from the capacitor body. Do not move C16 again.

2. Program the UUT for an output of 10 kHz at 5V rms, TERM, HI RANGE OVERRIDE.

3. Connect the precision 50Ω termination (GR874) through the Tee to the UUT 10 Hz - 11 MHz output.

4. Connect the RMS Voltmeter to the Tee.

CAUTION

Do not adjust L15 or L16 unless a P6201 FET probe is available for use with the spectrum analyzer.

5. Short TP2 to TP7 with as small a length of wire as possible.

6. Connect the spectrum analyzer through the P6201 FET probe to TP6 on the UUT, FET probe ground to chassis (use the shortest lead possible).

7. Adjust the spectrum analyzer tuning for 20 MHz.

8. Remove the short between TP2 and TP7.

9. Tune L15 to minimize the 20 MHz signal.

10. Tune L16 to maximize the 20 MHz signal.

11. Repeat steps 5 through 9 until adjustment of L16 produces no further increase in the 20 MHz signal.

12. Repeat steps 5 through 10 until there is no improvement.

a. Disconnect P9 from J9.

b. Connect a jumper from J9-4 to P9-4 (yellow wire) for range control.

c. Connect a ground wire from the module chassis to instrument chassis.

d. Connect −4.7 ±.01 Vdc from a stable external DC source to P9-2 (red wire-AM Level Control input).

13. Tune L14 for a maximum indication on the RMS Voltmeter.

14. Adjust R92 for a .1% null at 5V rms on the RMS Voltmeter.

15. Press the RANGE OVERRIDE control on the UUT. Verify that the LI range indicator illuminates.

16. Press the RANGE OVERRIDE control on the UUT. Verify that the LO range indicator illuminates.

CAUTION

Do not adjust C32 unless a P6201 FET probe is available for use with the spectrum analyzer. C32 should not require adjusting unless Q4, Q5, or Q15 has been replaced.

17. Obtain reference points at 1 MHz and 10.99999 MHz on the spectrum analyzer as follows:

a. Connect the spectrum analyzer to the reference synthesizer through a 20 dB attenuator.

b. Program the reference synthesizer for an output of 1 MHz at 0.3V rms TERM.

c. On the spectrum analyzer:

1. Adjust the controls for 2 MHz/division, 300 kHz resolution vs 2 dB/division scale.

2. Adjust the tuning control for a center frequency of 5 MHz.

3. Adjust the input attenuation for almost full-scale display.

4. Mark the level.

d. Program the reference synthesizer for 10.9999 MHz.

e. Mark the level on the spectrum analyzer.

18. Program the UUT for an output of 1 MHz at 5V rms, TERM.

19. Verify that the DC voltage externally applied to the AM Level Control input is –4.7 ±0.1V.

20. Connect the P6201 FET probe to the junction of R12 and R13. Connect FET ground to chassis with as short a lead as possible.

21. Adjust the spectrum analyzer gain until the signal amplitude is at the 1 MHz reference point.

22. Program the UUT for an output frequency of 10.99999 MHz.

23. Adjust C32 until the signal amplitude is at the 10.99999 MHz reference point on the spectrum analyzer.

24. Connect the spectrum analyzer through a 20 dB attenuator to the UUT 10 Hz - 11 MHz output.

25. Program the UUT for an output frequency of 10.175 MHz.

26. Center the 20.35 MHz harmonic on the spectrum analyzer.

27. Adjust the spectrum analyzer so the signal is nearly full-scale.

28. Program the UUT for an output frequency of 350 kHz.

29. Adjust L13 counter clockwise (ccw) until the 20.35 MHz signal increases.

30. Adjust L13 clockwise (cw) until the 20.35 MHz signal reaches a minimum.

31. Disconnect the spectrum analyzer.

32. Ground the AM Level Control input (P9-2).

33. Connect a DC coupled oscilloscope to the junction of R84 and the collector of Q20.

34. Adjust R140 for a dc level of less than 100 mV.

35. Disconnect the oscilloscope.

36. Logically reverse step 11.

37. Set the wave analyzer input to maximum attenuation.

38. Adjust the tuning to 90 kHz.

39. Connect the analyzer through a 50Ω termination to the UUT 10 Hz - 11 MHz output.

40. Program the UUT for an output of 90 kHz at 3V rms, TERM. (This is the maximum allowable input for the wave analyzer.)

41. Adjust the wave analyzer tuning for a maximum indication, and set this as reference level.

42. Program the UUT for an output frequency of 109.9999 kHz.

43. Adjust R77 for a minimum 90 kHz signal on the wave analyzer. This level must be at least –70 dB from the reference level.

44. Disconnect the wave analyzer.

45. Connect the spectrum analyzer through a 20 dB attenuator to the UUT 10 Hz - 11 MHz output.

46. Program the UUT for an output of 10.99999 MHz at 5V rms, TERM.

47. Adjust R46 to the center of its travel.

48. Adjust R46 to the point at which the harmonics first reach a minimum. Do not adjust beyond this point.

49. Verify that at this point the harmonics are greater than 40 dB down and the spurious components are greater than 60 dB from the fundamental.

50. Program the UUT for an output frequency of 1 MHz.

51. Verify that the harmonics are greater than 50 dB down from the fundamental.

52. Disconnect the spectrum analyzer.

53. Ground the AM Level Control input (J9-2).

54. Connect a dc coupled oscilloscope to the UUT 10 Hz - 11 MHz output.

55. Adjust R16 for an indication on the oscilloscope of 0 ±10 mV.

56. Program the UUT for an output of 10 kHz.

57. Repeatedly press the RANGE OVERRIDE control to shift back and forth between HI and LO ranges.

58. Adjust R142 to minimize the dc shift when shifting between ranges.

59. Perform all of the first level calibration adjustment - Output Level Adjustments except the last step.

NOTE

Perform the remaining steps only if the RMS Converter U16 has been replaced.

60. Connect the equipment as shown in Figure 4-1, Full Output Frequency Response.

61. Program UUT for an output of 10 kHz at 5V rms, TERM.

62. Record the DVM indication.

63. Program the UUT for an output frequency of 4 MHz.

64. Adjust C127 for a DVM indication that is the same as the level recorded in step 61.

4-54. Amplitude D/A Module Adjustments

4-55. Use the following procedure to adjust the Amplitude D/A Module. All test points and adjustments are shown in Figure 4-10, Amplitude D/A Module Test Points and Adjustments.

NOTE

During this procedure, programming words for level are specified for more digits than the level display contains. It is important to program all digits specified. Do not use stored levels as the storage positions do not include sufficient resolution.

1. Connect the DVM HI to TP4, LO to chassis.

2. Program the UUT for an output of 10 kHz at 9.999999V rms, OPEN.

3. Adjust R46 for a DVM indication of 5.0V ±1 mV.

4. Connect the DVM HI to the junction of C11 and R38.

5. Adjust R40 for a DVM indication of 0V ±100 mV.

6. Program the UUT for an output level of 2.6V rms, OPEN.

7. Connect the DVM HI to the DET SIG input of the Amplitude D/A Module.

8. Adjust R28 for a DVM indication of 1.3V ±10 mV.

9. Program the UUT for an output level of 7.899999V rms.

10. Record the DVM indication.

11. Program the UUT for an output level of 7.900099V rms.

12. Adjust R43 until the DVM indication is the same as that recorded in step 10.

13. Repeat steps 9 through 12 (eliminates interaction).

14. Program the UUT for an output level of 7.900899V rms.

15. Verify that the DVM indication changes by .4 to .5 mV.

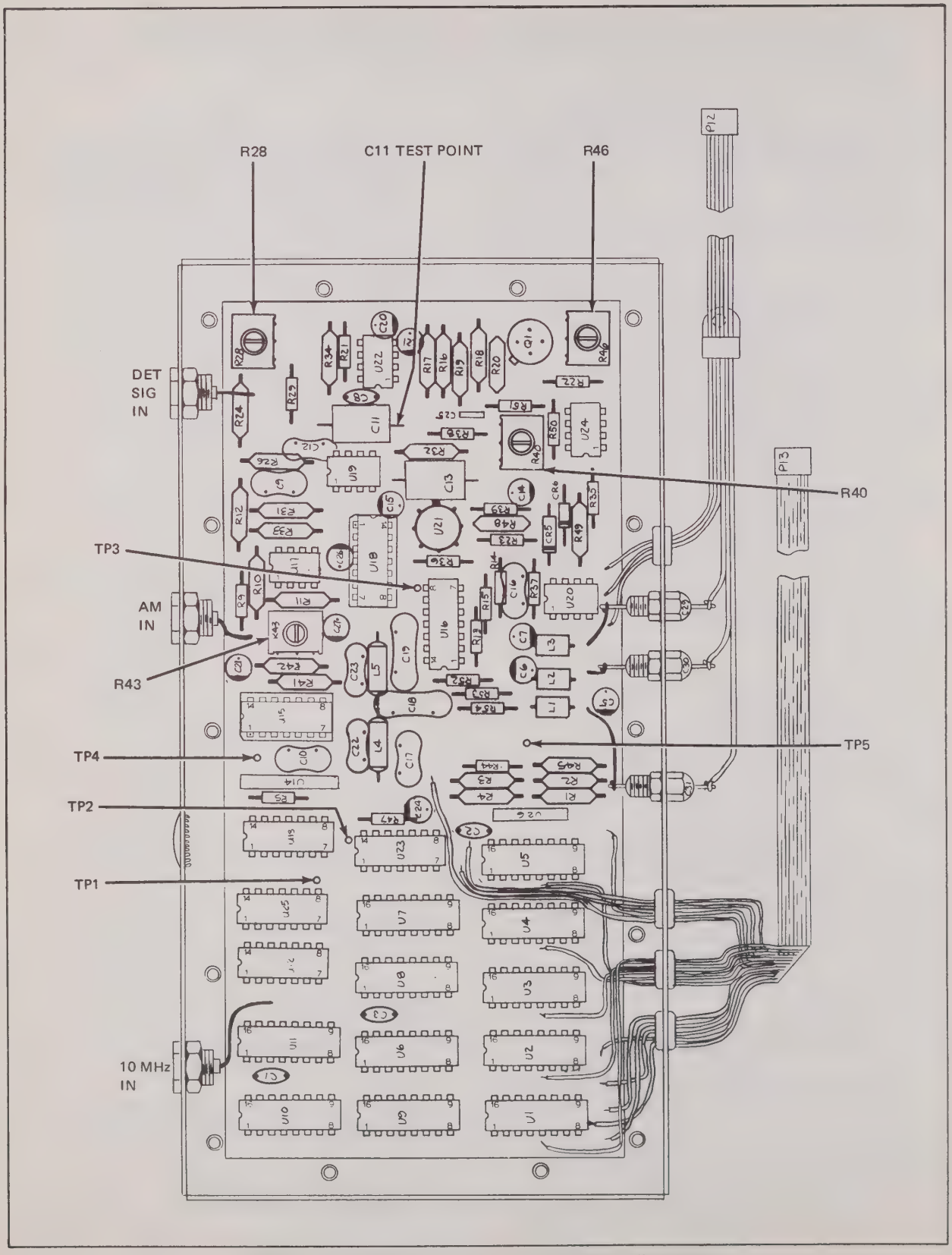


Figure 4-10. Amplitude D/A PCB Test Points and Adjustments

4-56. Six-Digit Generator Module Adjustments

4-57. The Six-Digit Generator Module is adjusted in five parts - the three step loops and the two main loops. The step loop adjustments set the VCO for each step loop to the correct frequency when zeros are selected for the appropriate decades. The main loop adjustments set the steering voltage for each main loop and check the loop for proper operation. The location of all test points and adjustments are shown in Figure 4-11, Six-Digit Generator Module Test Points and Adjustments.

4-58. A-B STEP LOOP ADJUSTMENTS

4-59. Use the following procedure to adjust the A-B step loop.

1. Program the UUT for an output frequency of zero.

2. Connect DVM HI to TP10, LO to chassis.

3. Adjust T5 until the top of the tuning slug is level with the inductor case.

4. Adjust T5 clockwise (cw) for a DVM indication of 3.5 ±0.1V.

5. Program the UUT for an output frequency of 9.9 MHz.

6. Verify that the DVM indication is greater than 1.9V.

4-60. C-D STEP LOOP ADJUSTMENT

4-61. Use the following procedure to adjust the C-D step loop.

1. Connect the DVM HI to TP13, low to chassis.

2. Program the UUT for an output frequency of 990.0 Hz.

3. Adjust T4 until the tuning slug is level with the top of the inductor case.

4. Adjust T4 clockwise (cw) for a DVM indication of 2.0 ±0.1V.

NOTE

For modules with a revision level up to s, adjust T4 for 2.5 ±0.1V.

5. Program the UUT for an output frequency of 0 kHz.

6. Verify that the DVM indication is 5.6 ±0.6V.

4-62. E-F STEP LOOP ADJUSTMENT

4-63. Use the following procedure to adjust the E-F step loop.

1. Connect the DVM HI to TP11 and LO to chassis.

2. Adjust T1 until the top of the tuning slug is level with the inductor case.

3. Program the UUT for an output frequency of 0 kHz.

4. Adjust T1 clockwise (cw) for a DVM indication of 2.0 ±0.1V.

NOTE

For modules with a revision level up to s, adjust T4 for 2.5 ±0.1V.

5. Program the UUT for an output frequency of 99.00 kHz.

6. Verify the DVM indication is 8.4 ±0.8V.

4-64. C-D MAIN LOOP ADJUSTMENT

4-65. Use the following procedure to adjust the C-D main loop.

1. Connect the DVM HI to TP12 and the LO to TP15.

2. Program the UUT for an output frequency of 9.9 Hz.

3. Adjust T3 for a DVM indication of 0.025 ±0.025V.

4. Rotate the EDIT CONTROL to vary the 0.1 Hz through 100 Hz digits.

5. Verify that the minimum DVM indication is 0.025 ±0.025V and the maximum DVM indication is at least 0.38V.

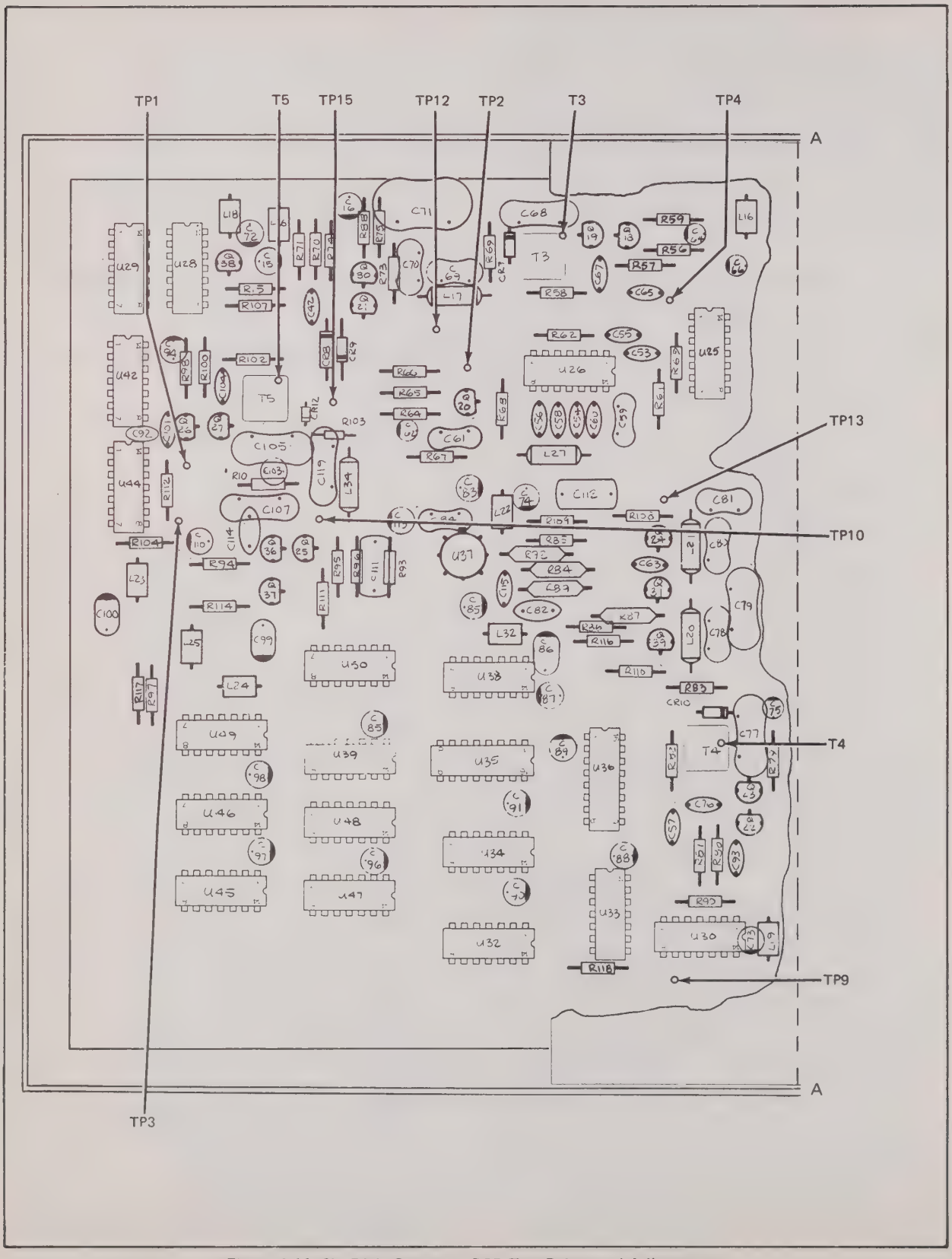


Figure 4-11. Six-Digit Generator PCB Test Points and Adjustments

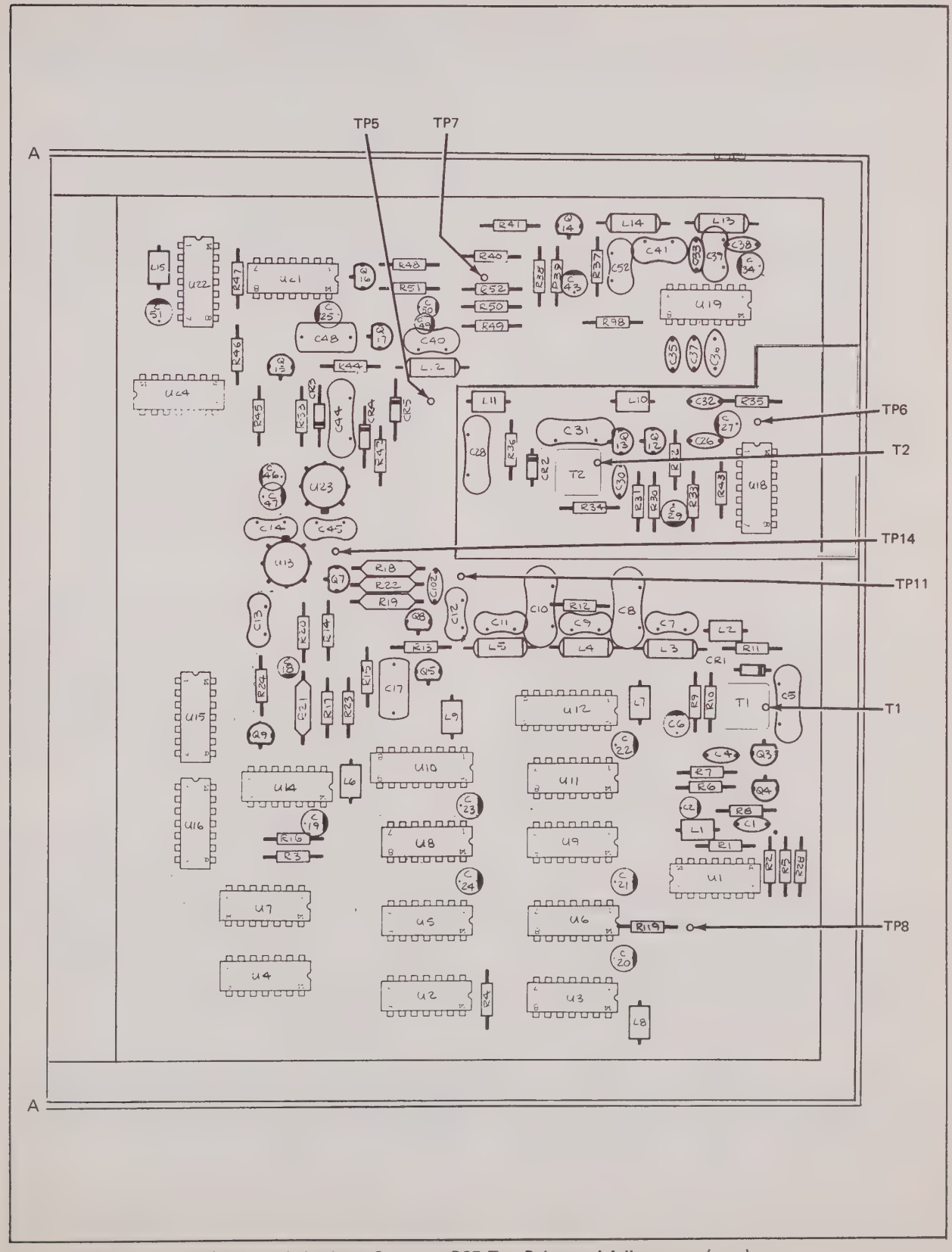


Figure 4-11. Six-Digit Generator PCB Test Points and Adjustments (cont)

4-67. Use the following procedure to adjust E-F main loop.

1. Connect the DVM HI to TP5 and LO to TP14.

2. Program the UUT for an output frequency of 99.9999 kHz.

3. Adjust T2 for a DVM indication of –0.175V to –0.025V.

4. Rotate the EDIT CONTROL to change the UUT output frequency to 99.9900 kHz.

5. Rotate the EDIT CONTROL to vary the 10 kHz through 10 Hz digits.

6. Verify that the maximum DVM indication is less than –0.15V (adjust T2 as necessary to maintain the maximum below –0.15V).

7. Verify that the minimum DVM indication is greater than –0.50V.

4-68. TROUBLESHOOTING

4-69. Introduction

4-70. If the instrument fails a performance check and cannot be adjusted back within operating specifications by either first or second level calibration adjustments or if the instrument exhibits abnormal symptoms, fault isolation is indicated. A thorough knowledge of operation and the theory of operation of the instrument is necessary before troubleshooting is attempted. It is recommended that Sections 2 and 3 of this manual be reviewed before proceeding. The material presented here is not meant to be a substitute for logical fault isolation. The material is meant as a guide.

WARNING

WHEN THE CASE COVERS ARE REMOVED, LETHAL VOLTAGES MAY BE EXPOSED. CARE SHOULD BE TAKEN TO AVOID THE CIRCUITRY BETWEEN THE POWER SUPPLY TRANSFORMER PRIMARY AND THE INPUT POWER CORD.

CAUTION

To prevent instrument damage, it is recommended that the power control be released before removing or installing pcbs and before making or breaking connectors.

4-71. Before proceeding, perform the Power Supply Adjustment in the First Level Calibration Adjustments to insure that the operating voltages are correct.

4-72. If the operating voltages are correct or if correcting the operating voltages does not eliminate the fault, proceed to Table 4-6, Model 6011A Fault Isolation Guide. This table will aid in isolating the fault to an individual pcb. Proceed to the portion of the text troubleshooting the faulty pcb.

4-73. Main PCB Controller Troubleshooting

4-74. The only portion of the Main PCB functions not covered by the Power Supply Adjustments that the competent technician may require aid in troubleshooting is the controller. Proceed to the paragraph headed by the symptom or suspect controller function. Visual aid is provided by Figure 4-8, Main PCB Test Points and Adjustments.

NOTE

The changing waveforms in the controller are difficult to monitor and interpret. Should a fault be suspected (data lines held high or low or changing to intermediate levels, etc.) IC substitution is the simplest method of troubleshooting. Special care should be taken with the IC's in this circuit to prevent static damage or broken leads.

4-75. NO DISPLAY

4-76. The two functions most likely to cause no display are the clock circuitry or the CPU Data Bus. Figure 4-12, Ø1-Ø2 Clock Relationship , illustrates the relationship between the two clock signals. It is very difficult to trigger an oscilloscope on the CPU Data Bus pulses. Monitoring these lines will only yield results if one or more of the lines are stuck high or stuck low. The associated IC chips are CPU (U26), CPU Interface (U29), RAMS (U27, U28, U41, and U42), and ROMS (U30, U43).

4-77. DISPLAY ERRORS

4-78. Display errors which occur in both the frequency and level displays are usually due to program faults. The most likely fault is in the ROMs, then the CPU. The level display consists of BCD information from RAM (U41). The frequency display consists of BCD information latched into U8. Each display has an associated decoder and driver located on the Front Panel Display PCB. Annunicator data is latched to U20.

4-79. TIMING ERRORS

4-80. Timing is controlled by the program. Logical use of the fault symptoms, Figure 3-3, Main PCB Functional Block Diagram, and the schematics in Section 8 should indicate the faulty circuit.

4-81. ATTENUATOR COMMANDS

4-82. Attenuator commands are steady-state outputs from RAM 2 (U42). The fault lies in the CPU, CPU Interface, or ROMs if RAM 2 is not defective.

Table 4-6. Model 6011A Fault Isolation Guide

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Apply power. Is a 0 displayed at the far left of the frequency display?	x		9
			x	2
2	Measure the voltages of the power supplies. Are the voltages correct?	x		6
			x	3
3	Remove the module power connectors one at a time from J5, J6, J7, J8, J9, J11 and J12. Are the voltages that were incorrect in step 2 now at the correct value?	x		4
			x	5
4	A short exists in the last module disconnected. Troubleshoot and repair.			1
5	There is a fault in either the indicated power supply or the Main PCB. Troubleshoot and repair.			1
6	Is the display blank?	x		7
			x	18
7	Check the 10 MHz output of the Input/Output PCB either at J3 of the Input/Output PCB or on the Main PCB. Is the 10 MHz present?	x		21
			x	8
8	The fault is in the Input/Output PCB. Troubleshoot and repair.			1
9	Complete the Performance Tests.			10
10	Does the instrument program properly as displayed by the front panel?	x		11
			x	17
11	Is there an output at the OUTPUT connector on the front panel?	x		12
			x	23
12	Are the frequencies correct as programmed?	x		13
			x	34
13	Are the outputs correct as programmed?	x		14
			x	34
14	Is the fault due to excessive noise, distortion or harmonic content?	x		15
			x	16
15	Refer to the NOISE PROBLEMS paragraphs in Section 4. Troubleshoot and repair.			1
16	There are no faults in the instrument. Synthesize away.			
17	Does the unit respond when a front panel control is depressed (excepting the POWER switch)?	x		18
			x	19
18	Is the displayed error in frequency or amplitude but not both?	x		22
			x	19
19	Are negative display strobe pulses (DT1 through DT8) present at either J1 or U7 on the Main PCB?	x		20
			x	21
20	Are negative keyboard data pulses (KD0 through KD3) present at the appropriate line at J2 or pin of U1, U2, U3 or U4 (on the Main PCB) when a keyboard switch is held depressed?	x		21
			x	22
21	The fault is probably in the Main PCB Controller. Troubleshoot and repair.			1
22	The fault is probably in the Front Panel Display PCB. Troubleshoot and repair.			1

Table 4-6. Model 6011A Fault Isolation Guide (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
23	Is there an output at the rear panel TTL OUT?	x		24
			x	25
24	The fault is in the Attenuator PCB. Troubleshoot and repair.			1
25	Is there an output from the Input/Output PCB present at J3 on the Attenuator PCB?	x		24
			x	26
26	Is there a negative dc voltage present at J9, pin 2 on the Main PCB?	x		28
			x	27
27	The fault is in the Amplitude D/A PCB. Troubleshoot and repair.			1
28	Is the output of the Six-Digit Generator PCB correct at J1 of the Input/Output PCB? Level > or = 2V p-p. Frequency = 20 MHz + programmed frequency (High Range) Frequency = 20 MHz + 100X programmed frequency (Low Range)	x		29
			x	30
29	The fault is in the Input/Output PCB. Troubleshoot and repair.			1
30	Is the 1 MHz output at J2 of the Input/Output PCB correct?	x		31
			x	29
31	Are the programming outputs of the Six-Digit Generator Decade Latches, U10 through U16 on the Main PCB correct according to Table 4-7, Outputs of the Main PCB's Six-Digit Generator Decade Latches?	x		32
			x	33
32	The fault is in the Six-Digit Generator PCB. Troubleshoot and repair.			1
33	The fault is in the controller circuitry on the Main PCB. Troubleshoot and repair.			1
34	Perform the AM/Level Analog vs Output Levels Procedure.			35
35	Do the AM/Level Analog and output levels match?	x		36
			x	38
36	Does the OUTPUT LEVEL match the AM/Level Analog and the DETECTOR SIGNAL OUTPUT?	x		37
			x	42
37	The fault is in the Amplitude D/A PCB. Troubleshoot and repair.			1
38	Perform the AM/Level Analog vs Output Levels Procedure except connect the RMS Voltmeter to J3 output of the Input/Output PCB instead of the OUTPUT terminal. Do the AM/Level Analog and the output signals match now?	x		39
			x	42
39	Are the program levels to the Attenuator PCB (Main PCB U18-6, U19-12 and U19-6) high?	x		40
			x	41
40	The fault is in the Attenuator PCB. Troubleshoot and repair.			1
41	The fault is in the Main PCB. Troubleshoot and repair.			1
42	The fault is in the Input/Output PCB. Troubleshoot and repair.			1

DECADES		10 MHz	f 1 MHz				e 100 kHz				d 10 kHz				c 1 kHz				b 100 Hz				a 10 Hz			
CONNECTOR J3 MAIN PCB		12	33	32	31	34	21	26	25	22	17	24	20	23	28	30	27	29	6	9	5	10	13	14	11	16
START	FREQ MHz	0	0				DP 0				0				0				0				0			
BCD INPUT LEVELS		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
RECALL 1	FREQ MHz	0	1				DP 1				1				1				1				1			
BCD INPUT LEVELS		L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L
RECALL 2	FREQ MHz	0	2				DP 2				2				2				2				2			
BCD INPUT LEVELS		L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L
RECALL 3	FREQ MHz	0	3				DP 3				3				3				3				3			
BCD INPUT LEVELS		L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L
RECALL 4	FREQ MHz	0	4				DP 4				4				4				4				4			
BCD INPUT LEVELS		L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L
RECALL 5	FREQ MHz	0	5				DP 5				5				5				5				5			
BCD INPUT LEVELS		L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
RECALL 6	FREQ MHz	0	6				DP 6				6				6				6				6			
BCD INPUT LEVELS		L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L
RECALL 7	FREQ MHz	0	7				DP 7				7				7				7				7			
BCD INPUT LEVELS		L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	L
RECALL 8	FREQ MHz	0	8				DP 8				8				8				8				8			
BCD INPUT LEVELS		L	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H
RECALL 9	FREQ MHz	0	9				DP 9				9				9				9				9			
BCD INPUT LEVELS		L	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H
RECALL 0	FREQ MHz	1	0				9				DP 8				7				6				5			
BCD INPUT LEVELS		H	L	L	L	L	H	L	L	H	L	L	L	H	H	H	H	L	L	H	H	L	H	L	H	L

Table 4-7. Outputs of the Main PCBs Six-Digit Generator Latches

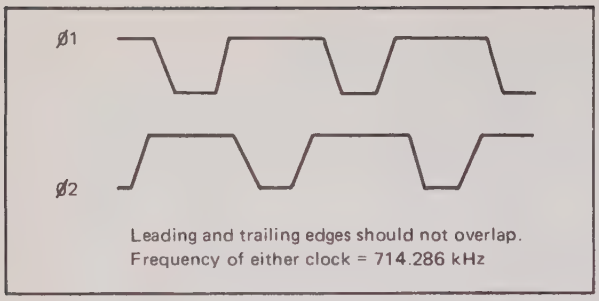


Figure 4-12. 01-02 Clock Relationship

4-83. FREQUENCY COMMANDS

4-84. Frequency commands are steady state BCD outputs on the Six-Digit Generator Latches (U10 through U16). If these IC chips are not defective, logically troubleshoot backwards using the Main PCB Functional Block Diagram, Figure 3-3 and the appropriate schematics in Section 8.

4-85. LEVEL COMMANDS

4-86. The level commands are latched into the input register on the Amplitude D/A PCB. These commands are processed through the Level Command Buffer U25 on the Main PCB. If these IC chips are not defective, logically troubleshoot backwards using the Main PCB Functional Block Diagram, Figure 3-3, and the appropriate schematics in Section 8.

4-87. Input/Output Module Troubleshooting

4-88. Use this text in conjunction with Figure 4-9, Input/Output PCB Test Points and Adjustments and the appropriate schematics in Section 8 to logically troubleshoot the Input/Output Module.

4-89. Program a frequency under 100 kHz and use the RANGE OVERRIDE control to determine if the fault exists in both ranges. If the fault occurs only in one range, troubleshoot the circuitry peculiar to that range.

4-90. OUTPUT LEVEL ERRORS

4-91. The AM/Level Analog vs Output Level Procedure describes how to break the level control loop. Do not change the adjustment of L15, L16, or C32 unless a P6201 FET probe is available. R92 is the overall gain adjustment. R126 is the LO range compensation adjustment.

4-92. AM/LEVEL ANALOG VS OUTPUT LEVELS PROCEDURE

4-93. Perform the following procedures then vary the AM/Level Analog voltage as indicated in Table 4-8, AM/Level Analog vs Output Levels and verify that the output voltages are as indicated in Table 4-8.

1. Disconnect J9 from P9 on the Input/Output PCB and apply an adjustable DC control voltage to P9, pin 2, (red wire). This DC control voltage simulates the AM/Level Analog signal.

2. Connect the Model 931B to the OUTPUT terminal on the front panel.

3. Connect a DVM to the Detector Signal Output of the Input/Output PCB (J6) to monitor the Detector Signal Output Level.

4. Program in 10 kHz at 5V, OPEN.

5. Vary the control voltage as shown in Table 4-8, AM/Level Analog vs Output Levels. Verify that the DVM and RMS Voltmeter indications are within the tolerances listed in Table 4-8.

Table 4-8. AM/Level Analog vs Output Levels*

AM/LEVEL ANALOG	OUTPUT LEVEL	DETECTOR SIGNAL OUTPUT LEVEL
–4.7 Vdc	10V rms	+4.9V dc
–4.2 Vdc	9V rms	+4.5V dc
–3.7 Vdc	8V rms	+4.0V dc
–3.2 Vdc	7V rms	+3.5V dc
–2.7 Vdc	6V rms	+3.0V dc
–2.3 Vdc	5V rms	+2.5V dc
–1.8 Vdc	4V rms	+2.0V dc
–1.4 Vdc	3V rms	+1.5V dc
– .9 Vdc	2V rms	+1.0V dc
– .5 Vdc	1V rms	+ .5V dc
0 Vdc	0V rms	0V dc

NOTE: To obtain the exact Output Level, both AM/Level Analog and Detector Signal Output Level may be ±2V, but the steps should be fairly linear.

4-94. Amplitude D/A Module Troubleshooting

4-95. Use the following procedure to logically troubleshoot the Amplitude D/A Module. Figure 4-10, Amplitude D/A PCB Test Points and Adjustments and the approriate schematic in Section 8 provide visual aids.

1. Verify that the data latched in U1 through U5 agrees with the programmed level. This data is latched BCD steady state outputs on the IC chips. U1 is the MSD, U4 the LSD and U5 a high resolution, round-off digit.

2. Program the UUT for an output level of 5.05V, OPEN.

3. Connect an oscilloscope to TP1.

4. Verify that the signal is a symmetrical square wave at TTL levels (high of 2-5V, low of 0-0.8V) and at a frequency of 101 kHz (period slightly less than 10 usec).

5. Rotate the DECADE control until the volts digit on the level display is brighter.

6. Rotate the DIGIT control clockwise (cw).

7. Verify that the pulse width of the negative portion increases as the value of the volts digit increases on the level display. Frequency should not change.

8. Rotate DIGIT control counterclockwise (ccw).

9. Verify that the pulse width of the negative portion decreases until the attenuator clicks in. Frequency should not change.

10. Program the UUT for an output level of 10V, OPEN.

11. Verify that TP1 goes to a TTL high level.

12. Program the UUT for an output level of 5.05V, OPEN.

13. Connect the oscilloscope to TP2.

14. Verify that the signal is a symmetrical square wave at TTL levels and at a frequency of 101 kHz (slightly less than 10 usec period).

15. Rotate the DECADE control until the hundredths volt digit on the level display is brighter.

16. Rotate the DIGIT control clockwise (cw) so the level display hundredths volt digit goes from 5 to 9.

17. Verify that the pulse width of the negative portion increases as the level display value increases. Frequency should not change.

18. Rotate the DIGIT control counterclockwise (ccw).

19. Verify that the pulse width decreases. Frequency should not change.

20. Rotate the DIGIT control clockwise (cw) until the level display hundredths volt digit goes to 10.

21. Verify that TP2 goes to a TTL low level.

22. Connect a DVM to TP3.

23. Program the UUT for an output level of 0.5V rms.

24. Verify that the DVM indication is +0.5V.

25. Program the UUT for an output level of 3.0V rms.

26. Verify that the DVM indication is +2.7V.

27. Connect the DVM to TP4.

28. Verify that the DVM indication is 5.0V.

29. Remove P9 from J9.

30. Inject a stable 2.5V from an external source into the DET SIG INPUT (J1).

31. Connect an oscilloscope to U19-6.

32. Rotate the EDIT CONTROL to vary the level display around 5V, OPEN.

33. Verify that the signal switches from positive to negative output.

34. Connect a DVM to J9-2 (AM/Level Analog Output).

35. Vary the external voltage injected into the DET SIG INPUT from 0V to 10V.

36. Verify that the DVM indication changes from –4V to 0V.

37. Connect P9 to J9.

4-96. Six-Digit Generator Module Troubleshooting

4-97. Synthesis errors and non-lock conditions may arise in any step or main loop. Check the operation of the step loops then the main loops. Test points and the expected conditions at each test point are listed in Table 4-9, Six-Digit Generator PCB Test Points. Unless otherwise specified, waveform periods are ±20%. Test point locations are shown in Figure 4-11, Six-Digit Generator PCB Test Points and Adjustments.

4-98. Noise

4-99. Noise generally arises from mechanical problems - loose hardware, loose or dirty connectors, poor solder joints (especially on shields), etc. One source is the coating material on capacitors extending so far down the leads that it causes poor connection. (Bypass capacitors are notorious). Tapping the modules lightly while observing the spectrum analyzer may help isolate mechanical noise problems.

Table 4-9. Signals at Six-Digit Generator PCB Test Points

	A-B STEP LOOP
TP1	Approximately .6V p-p sine (measure with a 10:1 probe).
TP3	Connect counter with 10:1 scope probe. Frequency = 27.5 - 25.025; 25 kHz/.1 Hz step, 250 kHz/1 Hz step. Frequency decreases as programmed frequency increases.
TP10	3.5V @ 0.0 Hz; 2.3V @ 9.9 Hz
U50 pin 3	Positive pulse; period measured at amplitude mid-point: for 0 Hz - 70 nsec, for 9.9 Hz - 45 nsec (approximately).
U50 pin 13	Negative pulse; period at amplitude mid-point: for 0 Hz - 130 nsec, for 9.9 Hz - 120 nsec (approximately).
	C-D STEP LOOP
TP9	Connect counter here with 10:1 scope probe. Frequency = 24.45 to 19.5 MHz; 50 kHz/10 Hz step, 500 kHz/100 Hz step. Frequency decreases as programmed frequency increases.
TP13	5.8V @ 0 Hz; 2.5V @ 990 Hz.
U38 pin 3	Positive pulse; period measured at amplitude mid-point: 145 nsec for 990 Hz, 115 nsec for 0 Hz.
U38 pin 13	Negative pulse; period measured at amplitude mid-point: 123 nsec for 990 Hz, 75 nsec for 0 Hz.
	E-F STEP LOOP
TP11	2.5V @ 0 Hz; 8.4V @ 99 kHz.
TP8	Connect counter with 10:1 scope probe. 100 kHz/1 kHz step 1 MHz/10 kHz step.
U14 pin 3	Positive pulse; period measured at amplitude mid-points: 140 nsec for 0 Hz, 95 nsec for 99 kHz.
U14 pin 13	Negative pulse; period at amplitude mid-points: 100 nsec for 0 Hz, 80 nsec for 99 kHz.

Table 4-9. Signals at Six-Digit Generator PCB Test Points (cont)

	C-D MAIN LOOP
TP12 - TP15	These test points are used in the adjustment of T3. Connect the DVM HI to TP12, LO to TP15 - the voltage difference will vary as the 100 Hz through .1 Hz digits are edited. The minimum should be .025 ±.025V; the maximum < .35V. A greater maximum indicates the varactor diodes are improperly matched (CR7, CR10).
TP4	Connect a counter through a 10:1 probe. Frequency varies inversely as the programmed frequency from 25 to 20 MHz. Voltage varies from .5 to .7V p-p.
TP2	Positive pulse approximately 800 nsec. The slope of leading and trailing edges as measured from the 0V point to the 3V point (use dc coupled scope) must be less than 200 nsec for the leading edge and < 150 nsec for the trailing edge.
U28 pin 13	Negative pulse; period at amplitude mid-point is 175 nsec with 990 Hz programmed, 85 nsec @ 0 Hz, and 205 nsec @ 9.90 Hz.
	E-F MAIN LOOP
TP5 - TP14	These test points are used in the adjustment of T2. Connect the DVM HI to TP5, LO to TP14 - the voltage difference will vary as the 100 kHz through 10 Hz digits are edited - the smallest difference should be −.15V and the largest −.5V or smaller. A larger difference than −.5V indicates improper tacking of the varactor diodes (CR1, CR2).
TP6	Located under the shield - frequency 20-31 MHz - use 10:1 scope probe.
TP7	Positive pulse approximately 800 nsec. The slope of the leading and trailing edges as measured from the 0V point to the 3V point (use dc coupled scope) must be < 200 nsec for the leading edge and < 150 nsec for the trailing edge.
U21 pin 13	Negative pulse - program 999.9 Hz - pulse width as measured at amplitude mid-points should be 105 nsec.

Section 5
List of Replaceable Parts

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5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alpha-numerically by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. Component location illustrations are contained in Section 8 along with the respective schematic.

5-3. Parts lists include the following information:

1. Reference Designation or Item Number.

2. Description of each part.

3. FLUKE Stock Number.

4. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)

5. Manufacturer's Part Number or Type.

6. Total Quantity per assembly or component.

7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

8. Use Code: This entry indicates flags for notes appearing at the end of that parts list table. The number in the Use Code column corresponds to the note number.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory not and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.
2. FLUKE Stock Number.
3. Description.
4. Reference Designation or Item Number.
5. Printed Circuit Board Part Number.
6. Instrument Model and Serial Number.

⊗ CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. Final Assembly Model 6011A

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY MODEL 6011A						
	FIGURE 5-1						
A1	FRONT PANEL ASSY	ORDER	NEXT	HIGHER ASSY			
A2	MAIN PCB ASSY	412619	89536	412619	1		
A3	INPUT/OUTPUT MODULE ASSY	412635	89536	412635	1		
A4	SIX-DIGIT GENERATOR MODULE ASSY	388058	89536	388058	1		
A5	ATTENUATOR MODULE ASSY	412643	89563	412643	1		
A6	AMPLITUDE D/A MODULE ASSY	412650	89536	412650	1		
B1	FAN, WHISPER	255562	82877	027117	1		
C1	CAP, ELECT, 12,700UF +50/-10%, 15-18V	417774	56289	36DX8945	1	1	
F1	FUSE, 1 AMP, SLOW BLOW	109272	71400	MDL1	1	5	
H1	SCREW, FHP, 6-32 1/2	114397	73734	18246	4		
H2	SCREW, FH UNDERCUT, 6-32 X 1/4	320093	89536	320093	11		
H3	KNOB, MALE HALF, BLACK	309047	89536	309047	2		
H4	WASHER, SPRING	228981	78189	3502-24-29-4102	2		
H5	SCREW, FHP, 8-32 X 1	114561	89536	114561	2		
H6	KNOB, FEMALE HALF, BLACK	309054	89536	309054	2		
H7	NUT, HEX, 6-32	110551	89536	110551	4		
H8	SCREW, PHP, 6-32 X 5/8	152181	73734	19047	4		
H9	NUT, HEX, W/LK, 6-32	152819	78189	511-061800-00	11		
H10	LUG, SOLDER, BRASS	101030	79963	174	1		
H11	LUG, SOLDER, COPPER	169409	79963	29A	1		
H12	CLAMP, CAP	185801	56289	4586-97A	1		
H13	SCREW, MCH, 6-32 X 1/4	272799	89536	272799	1		
H14	ANCHOR, CABLE	408443	06915	KKC-2	14		
H15	SCREW, PHP, 6-32 X 1/2	320051	89536	320051	1		
H16	BUSHING, SNAP, 0.25ID	102996	28520	SB-375-4	1		
H17	TAPE, FOAM, 1/16 X 1-3/4	330043	89536	330043	1FT		
H18	SCREW, FHP, 8-32 X 3/8	114116	73734	18264	14		
H19	SCREW, FHP, 8-32 X 1/2	114355	73734	18266	6		
H20	SCREW, FHP, 4-40 X 3/8	256024	89536	256024	10		
H21	WASHER	110775	73734	1442	2		
H22	SCREW, PHP, 4-40 X 3/8	152124	73734	19024	2		
H23	SCREW, CAP, 8-32	295105	89536	295105	4		
H24	SCREW, FHP, 6-32 X 3/8	306183	89536	306183	5		
H25	SCREW, SEMS, PHP, 4-40 X 1/4	185918	89536	185918	2		
H26	SCREW, PHP, W/LK, 6-32 X 1/4	178533	89536	178533	2		
H27	SCREW, PHP, 8-32 X 1/4	320044	89536	320044	6		
MP1	COVER, TOP	427575	89536	427575	1		
MP2	COVER, BOTTOM	427567	89536	427567	1		
MP3	FOOT, BAIL STAND	292870	89536	292870	4		
MP4	DECAL, CORNER	296269	89536	296269	4		
MP5	DECAL, SIDE TRIM	407924	89536	407924	2		
MP6	INSERT, FOOT	302026	89536	302026	4		
MP7	GRIP, HANDLE	284836	89536	284836	2		
MP8	HANDLE, FRAME	310045	89536	310045	1		
MP9	KNOB, DECAL	285221	89536	285221	2		
MP10	INSTRUCTION MANUAL 6011A (NOT SHOWN)	424769	89536	424769	1		
MP11	INSTRUCTION PAGES ASSY 6011A	440339	89536	440339	1		
MP12	INSTRUCTION PAGES HOLDER	427534	89536	427534	1		

Table 5-1. Final Assembly Model 6011A (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP13	DECAL, WARNING	232116	89536	232116	1		
MP14	FAN, GUARD	407650	82877	476042	1		
MP15	GUARD, CABLE	406967	89536	406967	1		
MP16	TIE, CABLE	172080	06383	SST-1	2		
MP17	PANEL, REAR	412494	89536	412494	1		
MP18	CHASSIS, LEFTHAND	387902	89536	387902	1		
MP19	CHASSIS, RIGHTHAND	387910	89536	387910	1		
MP20	CORNER, REAR	406702	89536	406702	2		
MP21	CORNER, FINISHED	406694	89536	406694	2		
MP22	HEATSINK, SUPPORT	405449	89536	405449	1		
MP23	BUMPER	358341	52152	SJ5003	3		
MP24	CORDSET	363481	89536	363481	1		
MP25	PUSH BUTTON, GREEN	268862	71590	J61993	1		
MP26	CONN, POWER, RECEPTACLE	284166	82389	EAC301	1		
SMP	SWITCH, MAIN POWER	291526	89536	291526	1		
SPS	SWITCH, POWER SELECT	226274	89536	226274	1		
ST1	THERMOSTAT	344002	89536	344002	1		
T1	TRANSFORMER	396903	89536	396903	1		
W1	CABLE, #1	259754	89536	259754	1		
W2	CABLE, #2	333088	89536	333088	1		
W3	CABLE, #3	406629	89536	406629	1		
W4	CABLE, #6	353383	89536	353383	1		
W5	CABLE, #9	259747	89536	259747	1		
W6	CABLE, #13	205872	89536	205872	1		
XF1	FUSE HOLDER	407775	75915	341-001AL	1		

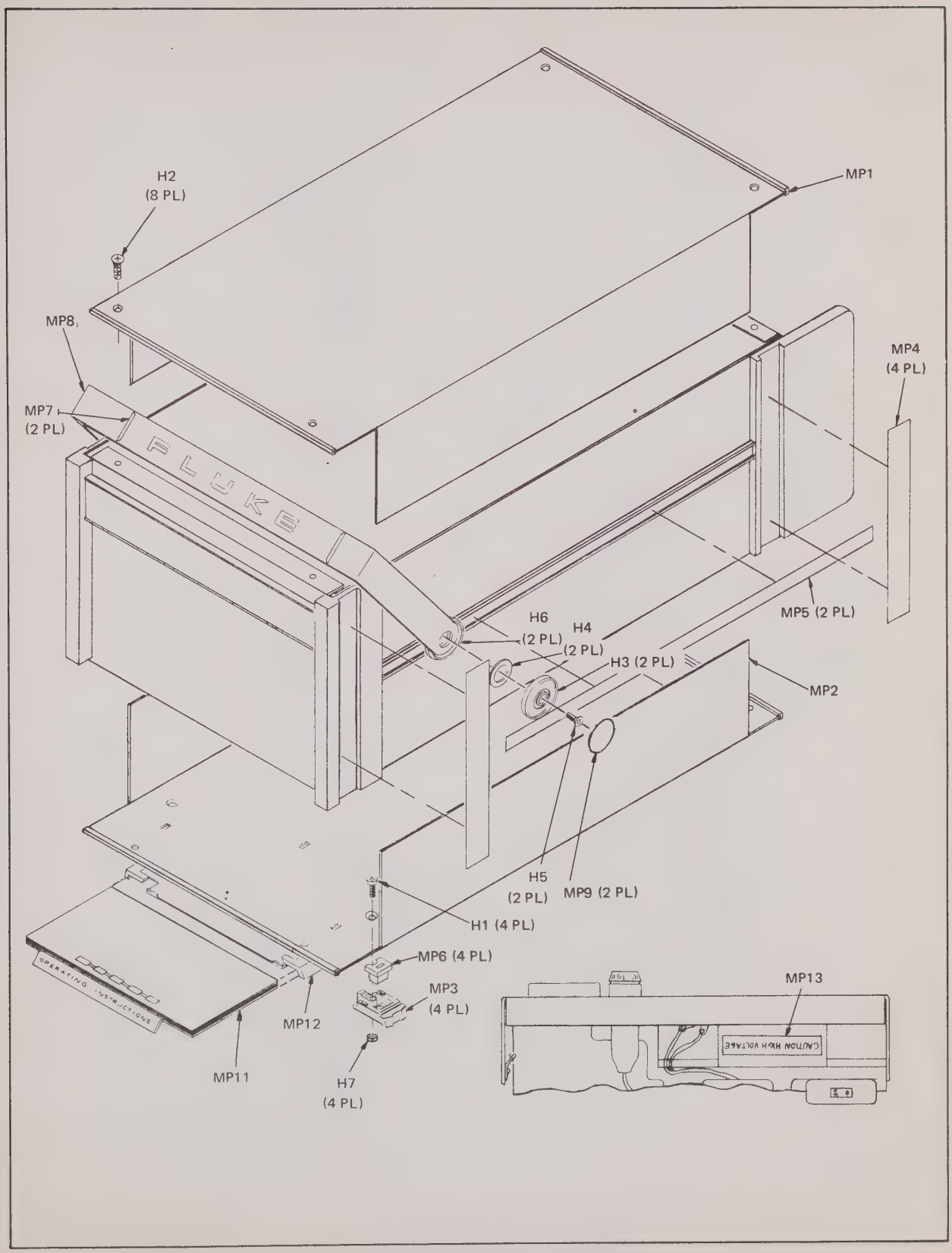

Figure 5-1. Final Assembly

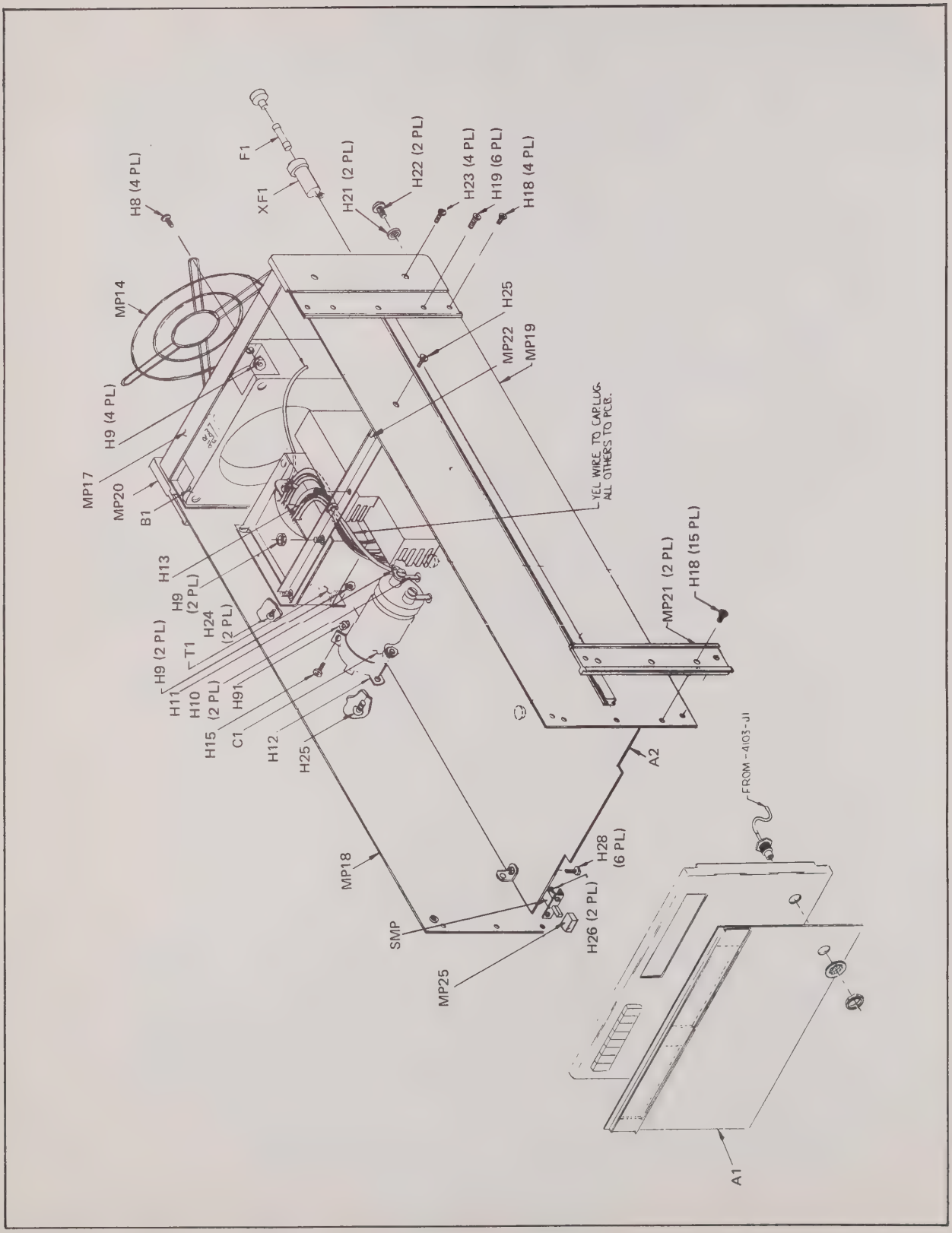

Figure 5-1. Final Assembly (cont)

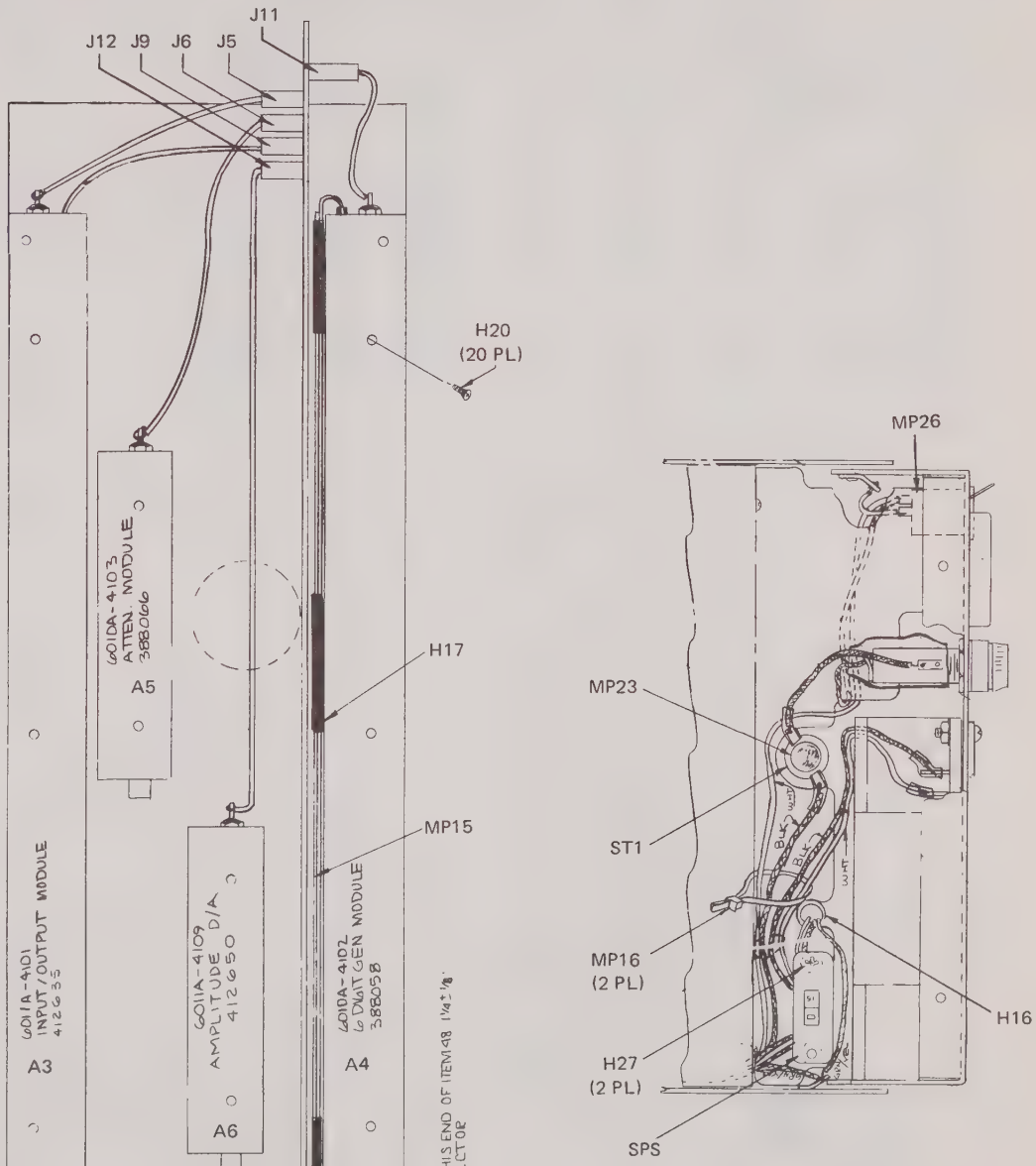

Figure 5-1. Final Assembly (cont)

Table 5-2. A1 Front Panel Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	FRONT PANEL ASSEMBLY FIGURE 5-2 (6011A-4451)	ORDER	NEXT	HIGHER ASSY			
A1A1	DISPLAY PCB ASSY	412627	89536	412627	1		
H1	SCREW, UNDERCUT, 4-40 X 5/16	268193	89536	268193	3		
H2	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	6		
H3	WASHER, SPLIT-LOCK	110395	89536	110395	6		
MP1	PANEL, FRONT	ORDER	NEXT	HIGHER ASSY			
MP2	LENS HOLDER	416545	89536	416545	1		
MP3	DECAL, FRONT PANEL	416909	89536	416909	1		
MP4	LENS	416891	89536	416891	1		
MP5	DECAL	407239	89536	407239	1		
MP6	KNOB, GREY KNURLED	341396	89536	341396	1		
MP7	KNOB, INNER	395228	89536	395228	1		
MP8	NAMEPLATE	393975	89536	393975	1		

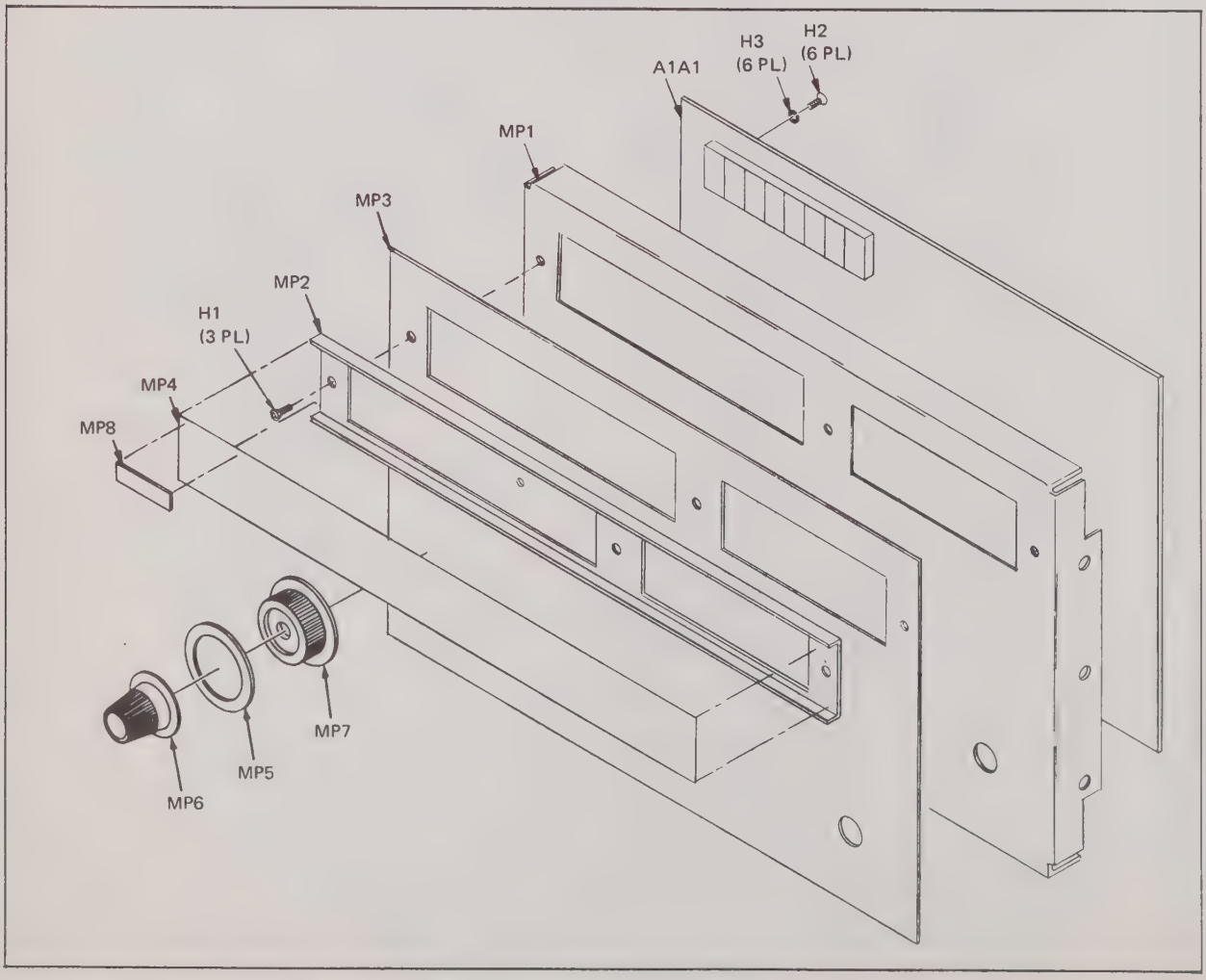

Figure 5-2. A1 Front Panel Assembly

Table 5-3. A1A1 Front Panel Display PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A1	FRONT PANEL DISPLAY PCB ASSY FIGURE 5-3 (6011A-4005)	412627	89536	412627	REF		
C1	CAP, MICA, 39UF +/-20%, 6V	163915	56289	196D396X0006KA1	2		
C2	CAP, MICA, 39UF +/-20%, 6V	163915	56289	196D396X0006KA1	REF		
CR1	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	8	2	
CR2	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR3	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR4	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR5	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR6	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR7	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR8	DIODE, GE (WHITE DOT INDICATES CATHODE)	149187	93332	1N270	REF		
CR9	DIODE, HI-SPEED SWITCHING	203323	07910	1N4448	1	1	
DS1	DISPLAY LED, ORANGE	407874	50522	MAN4610	2	1	
DS2	DISPLAY LED, ORANGE	407874	50522	MAN4610	REF		
DS3	DISPLAY LED, RED	428623	12040	FLV102	15	3	
DS4	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS5	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS6	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS7	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS8	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS9	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS10	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS11	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS12	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS13	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS14	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS15	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS16	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS17	DISPLAY, LED, RED	472944	50579	DL707-811	11	3	
DS18	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS19	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS20	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS21	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS22	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS23	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS24	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS25	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS26	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS27	DISPLAY, LED, RED	472944	50579	DL707-811	REF		
DS28	DISPLAY LED, RED	428623	12040	FLV102	REF		
DS29	DISPLAY, LED, RED	472951	50522	MAN3630A	2	1	
DS30	DISPLAY, LED, RED	472951	50522	MAN3630A	REF		
E1	TERMINAL	179283	88245	2010B-6	1		
H1	NUT, SW, 3/8-32	149718	89536	149718	1		
H2	WASHER, FLAT	245811	73734	5710-121-15	1		
H3	WASHER, FLAT	110007	89536	110007	1		
MP1	MASK, SW, LED (NOT SHOWN)	428904	89536	428904	1		
MP2	MASK, LED (NOT SHOWN)	418996	89536	418996	2		
P1	CONN, BOARD EDGE	291922	00779	583650-5	2		

Table 5-3. A1A1 Front Panel Display PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
P2	CONN, BOARD EDGE	291922	00779	583650-5	REF		
Q1	XSTR, SI, PNP	352369	12040	2N4403	8	2	
Q2	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q3	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q4	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q5	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q6	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q7	XSTR, SI, PNP	352369	12040	2N4403	REF		
Q8	XSTR, SI, PNP	352369	12040	2N4403	REF		
R1	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	3		
R2	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	REF		
R3	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	REF		
R4	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	6		
R5	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	5		
R6	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	REF		
R7	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	REF		
R8	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	REF		
R11	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R12	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R13	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R14	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R15	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R16	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	REF		
R17	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	1		
S1	SWITCH, ROTARY	408260	89536	408260	1		
S2	SWITCH, ROTARY	408260	89536	408260	REF		
S3-S34	SWITCHES, FRONT PANEL	ORDER	FROM	PARTS BELOW			
	ACTUATOR, SWITCH	412106	89536	412106	32		
	CONTACT, SWITCH	416875	00779	62313	32		
	CONTACT, SPRING	414516	00779	62312	32		
	COVER, SWITCH	401299	89536	401299	32		
	PUSHBUTTON, BLUE	406736	89536	406736	1		
	PUSHBUTTON, LIGHT GREY	401307	89536	401307	9		
	PUSHBUTTON, DARK GREY	406728	89536	406728	6		
	PUSHBUTTON, YELLOW	419937	89536	419937	2		
	PUSHBUTTON, WHITE	406744	89536	406744	12		
U1	IC, BCD/7 SEGMENT DCDR	340109	01295	SN7447AN	2	1	
U2	IC, BCD/7 SEGMENT DCDR	340109	01295	SN7447AN	REF		
U4	RESISTOR NETWORK, 6K, 14 PIN	355131	89536	355131	1	1	
U5	RESISTOR NETWORK, 82	379008	89536	379008	3	1	
U6	RESISTOR NETWORK, 82	379008	89536	379008	REF		
U7	RESISTOR NETWORK, 82	379008	89536	379008	REF		
XDS1	SOCKET, DS, 14 PIN	418723	01295	C921400	15		
XDS2	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS17	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS18	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS19	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS20	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS21	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS22	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		

Table 5-3. A1A1 Front Panel Display PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
XDS23	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS24	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS25	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS26	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS27	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS29	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		
XDS30	SOCKET, DS, 14 PIN	418723	01295	C921400	REF		

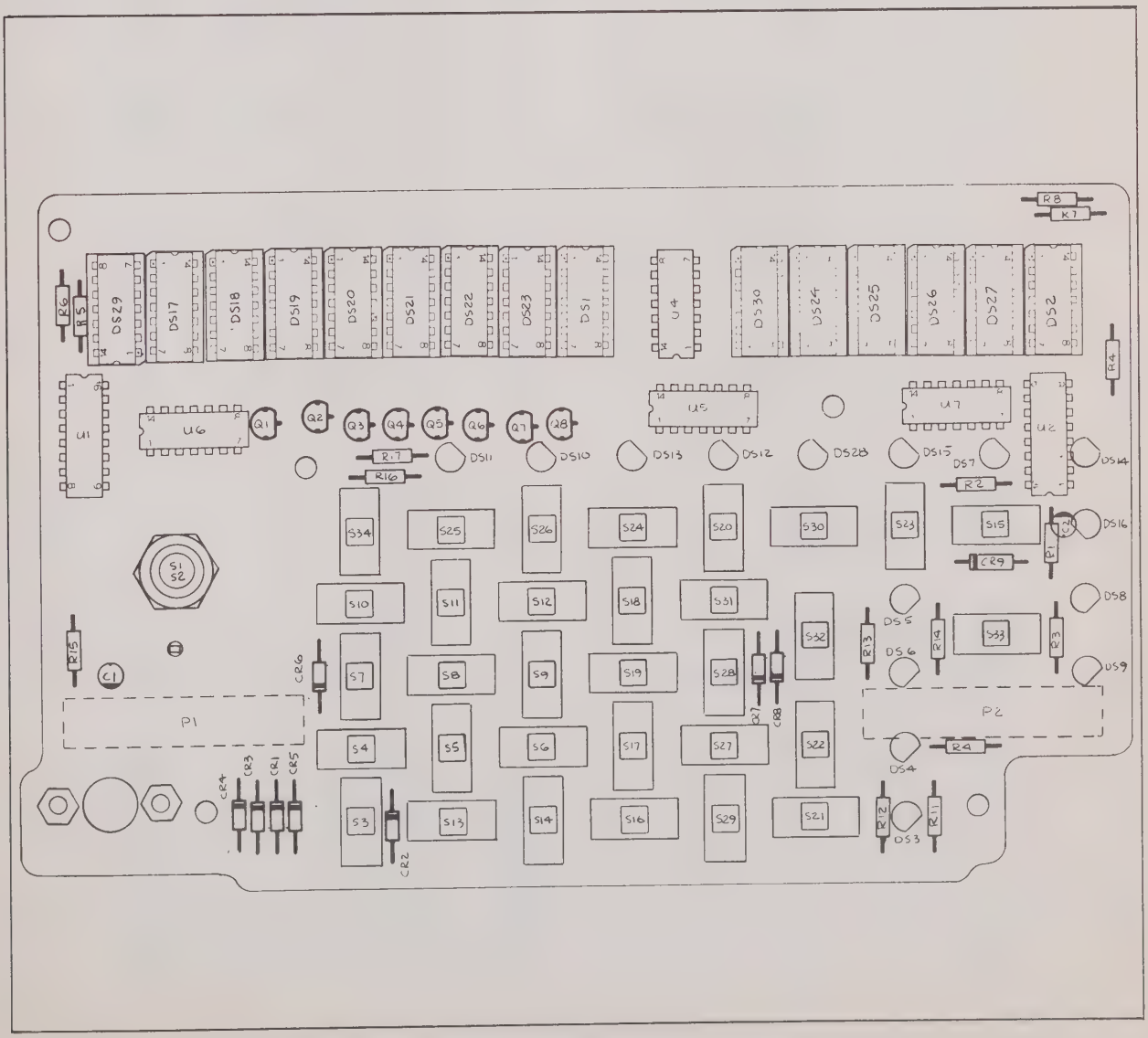

Figure 5-3. A1A1 Front Panel Display PCB Assembly

Table 5-4. A2 Main PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A2	MAIN PCB ASSY	412619	89536	412619	REF		
	FIGURE 5-4 (6011A-4004)						
C1	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	14		
C2	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C3	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C4	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C5	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C6	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C7	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	4		
C8	CAP, ELECT, 2100UF +100/-10%, 40V	370742	25088	B41010-2100-40	2	1	
C9	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C10	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	REF		
C11	CAP, TA, 6.8UF +/-20%, 35V	363713	56289	196D685X0020KA1	2		
C12	CAP, TA, 6.8UF +/-20%, 35V	363713	56289	196D685X0020KA1	REF		
C13	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	3		
C14	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C15	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C17	CAP, ELECT, 2100UF +100/-10%, 40V	370742	25088	B41010-2100-40	REF		
C18	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	REF		
C19	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C20	CAP, TA, 47UF +/-20%, 20V	348516	56289	196D476X0020TE4	2		
C21	CAP, TA, 47UF +/-20%, 20V	348516	56289	196D476X0020TE4	REF		
C22	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C23	CAP, TA, 0.47UF +/-20%, 35V	161349	56289	196D474X0035HA1	1		
C24	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C25	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C26	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C27	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C28	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C29	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	REF		
C30	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-052-651M	1	1	
CR1	DIODE, BRIDGE	296509	09423	FB200	1	1	
CR2	DIODE, SI, MULTI-PELLET	375485	09214	MPD300	1	1	
CR3	DIODE, RECTIFIER, SI	325746	04713	MR751	2	1	
CR4	DIODE, RECTIFIER, SI	325746	04713	MR751	REF		
CR5	DIODE, ZENER, 15V, 5%	266601	07910	1N965B	2	1	
CR6	DIODE, ZENER, 15V, 5%	266601	07910	1N965B	REF		
CR7	DIODE, RECTIFIER, SI	116111	18323	1N4817	4	1	
CR8	DIODE, RECTIFIER, SI	116111	18323	1N4817	REF		
CR9	DIODE, SI, HI-SPEED SWITCHING	203323	07910	1N4148	1	1	
CR10	DIODE, RECTIFIER, SI	116111	18323	1N4817	REF		
CR11	DIODE, RECTIFIER, SI	116111	18323	1N4817	REF		
H1	SCREW, 6-32 X 1/4	272799	89536	272799	8		
H2	SCREW, SEMS, 6-32 X 1/4	178533	89536	178533	2		
H3	SCREW, FHD, 6-32	385799	89536	385799	2		
H4	SCREW, 8-32 X 1/4	320044	73734	19062	2		
H5	WASHER, MICA	412809	13103	43-77-8	5		
H6	SPACER, STANDOFF	306084	89536	306084	2		
J3	TERMINAL	379438	00779	86144-5	34		
J4	CONNECTOR, FEMALE	408898	13511	57-20240-2(383)	1		

Table 5-4. A2 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
J5	AMP PINS	267500	00779	86144-2	37		
J6	AMP PINS	267500	00779	86144-2	REF		
J7	AMP PINS	267500	00779	86144-2	REF		
J8	AMP PINS	267500	00779	86144-2	REF		
J9	AMP PINS	267500	00779	86144-2	REF		
J10	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
J11	AMP PINS	267500	00779	86144-2	REF		
J12	AMP PINS	267500	00779	86144-2	REF		
J13	SOCKET, IC (USED AS A CONNECTOR)	370304	01295	C931402	1		
MP1	BAIL	412718	02660	57-1002-02	1		
MP2	BRACKET, ANGLE (NOT SHOWN)	306225	89536	306225	2		
MP3	HEAT SINK	390492	89536	390492	1		
MP4	HOLDER, COMPONENT	104794	98159	2829-115-3	2		
MP5	LATCH	412700	02660	57-1001	8		
MP6	PLATE, CONN	391052	89536	391052	1		
Q1	XSTR, SI, PNP	325753	03508	D45C5	2	1	
Q2	XSTR, SI, PNP	325753	03508	D45C5	REF		
Q3	XSTR, SI, NPN	195974	04713	2N3906	1	1	
R1	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	8		
R2	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	2		
R3	RES, COMP, 150 +/-5%, 1/4W	147934	01121	CB1515	1		
R4	RES, COMP, 1.2 +/-5%, 1/2W	218701	01121	EB12G5	2		
R5	RES, MF, 3.40K +/-1%, 1/8W	260323	91637	MFF1-83401F	1		
R6	RES, VAR, CER, 500 +/-10%, 1/2W	325613	71450	360T501A	2	1	
R7	RES, MF, 3.57K +/-1%, 1/8W	226217	91637	MFF1-83571F	1		
R8	RES, MF, 1.87K +/-1%, 1/8W	267229	91637	MFF1-81871F	1		
R9	RES, COMP, 360 +/-5%, 1/4W	340844	01121	CB3615	1		
R10	RES, COMP, 1.2 +/-5%, 1/2W	218701	01121	EB12G5	REF		
R11	RES, MF, 3.01K +/-1%, 1/8W	312645	91637	MFF1-83011F	2		
R12	RES, MF, 3.01K +/-1%, 1/8W	312645	91637	MFF1-83011F	REF		
R13	RES, MF, 5.62K +/-1%, 1/8W	235168	91637	MFF1-85621F	1		
R14	RES, VAR, CER, 500 +/-10%, 1/2W	325613	71450	360T501A	REF		
R15	RES, MF, 1.78K +/-1%, 1/8W	349092	91637	MFF1-81781F	1		
R16	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	2		
R17	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	REF		
R18	RES, COMP, 680K +/-5%, 1/4W	188433	01121	CB6845	1		
R19	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R20	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R23	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R24	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	1		
R25	RES, COMP, 22K+/-5%, 1/4W	148130	01121	CB2235	2		
R26	RES, COMP, 5.6K +/-5%, 1/4W	148080	01121	CB5625	3		
R27	RES, COMP, 5.6K +/-5%, 1/4W	148080	01121	CB5625	REF		
R28	RES, COMP, 5.6K +/-5%, 1/4W	148080	01121	CB5625	REF		
R29	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R30	RES, COMP, 51 +/-5%, 1/4W	221879	01121	CB5105	1		
R31	RES, COMP, 22K+/-5%, 1/4W	148130	01121	CB2235	REF		
R32	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R33	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R34	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		

Table 5-4. A2 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R35	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R36	RES, COMP, 33 +/-5%, 1/4W	175034	01121	CB3305	1		
R46	RES NETWORK, 10K	414003	89536	414003	3	1	
R47	RES NETWORK, 10K	414003	89536	414003	REF		
R48	RES NETWORK, 10K	414003	89536	414003	REF		
U1	IC, TTL, LO-PWR, DATA SELECT MUX	407577	01295	SN74LS251N	4	1	
U2	IC, TTL, LO-PWR, DATA SELECT MUX	407577	01295	SN74LS251N	REF		
U3	IC, TTL, LO-PWR, DATA SELECT MUX	407577	01295	SN74LS251N	REF		
U4	IC, TTL, LO-PWR, DATA SELECT MUX	407577	01295	SN74LS251N	REF		
U5	IC, TTL, LO-PWR SCHOTTKY DECODER	407585	01295	SN74LS138N	1	1	
U6	IC, PRESET DECADE OR BINARY CNTR LATCH	393264	01295	SN74LS197N	1	1	
U7	IC, TTL, MSI, BCD TO DEC DRVR	293175	01295	SN74145N	1	1	
U8	IC, TTL, QUAD D F/F	407601	12040	DM86L13	9	2	
U9	RES, NETWORK, DIP, 10K	355305	89536	355305	1	1	
U10	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U11	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U13	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U14	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U15	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U16	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U17	IC, TTL, POS-NAND, QUAD 2-INPUT	393033	01295	SN74LS00N	1	1	
U18	IC, TTL, HEX INVERTER	352039	01295	SN74L04N	3	1	
U19	IC, TTL, HEX INVERTER	352039	01295	SN74L04N	REF		
U20	IC, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U21	IC, TTL, HEX INVERTER/BUFFER/DIV	288605	01295	SN7416N	1	1	
U22	IC, TTL, LO-PWR SCHOTTKY	393125	01295	SN74LS74N	1	1	
U23	IC, TTL, DECADE CNTR	402545	01295	SN74LS90N	1	1	
U24	IC, DGTL, MOS, CLOCK GEN	404459	34649	C4201	1	1	
U25	IC, TTL, HEX INVERTER	352039	01295	SN74L04N	REF		
U26	IC, DGTL, CPU	404418	34649	CPU4040	1	1	
U27	IC, DGTL, RAM 80-4 X 4 OUTPUT LINES	404442	34649	P4002-1	2	1	
U28	IC, DGTL, RAM 80-4 X 4 OUTPUT LINES	404442	34649	P4002-1	REF		
U29	IC, DGTL, STANDARD MEMORY	404434	34649	P4289	1	1	
U30	IC, ROM	418038	89536	418038	1	1	
U31	IC, LIN VOLTAGE REGULATOR	379420	04713	MC1723CL	2	1	
U32	IC, LIN VOLTAGE REGULATOR	379420	04713	MC1723CL	REF		
U33	IC, LIN VOLTAGE REGULATOR	407627	07263	F7808UC	1	1	
U34	IC, LIN NEG VOLTAGE REGULATOR	407635	04713	MC7908CP	2	1	
U35	IC, LIN VOLTAGE REGULATOR	355107	07263	F7804UC	3	1	
U36	IC, LIN VOLTAGE REGULATOR	355107	07263	F7804UC	REF		
U37	IC, LIN VOLTAGE REGULATOR	355107	07263	F7804UC	REF		
U38	IC, LIN NEG VOLTAGE REGULATOR	407635	04713	MC7908CP	REF		
U39	IC, DIG, POS-NAND GATES	293076	01295	SN74H04N	1	1	
U40	IC, DIG, C-MOS, HEX BUFFER/INVERTER	381848	89536	381848	1	1	
U41	IC, DIG, RAM, 80 X 4 4-OUTPUT	404467	34649	P4002-2	2	1	
U42	IC, DIG, RAM, 80 X 4 4-OUTPUT	404467	34649	P4002-2	REF		
U43	IC, DIG, MOS, N-CHANNEL	418046	89536	418046	1	1	
U44	RES NETWORK, 33	413575	89536	413575	2	1	
U45	RES NETWORK, 33	413575	89536	413575	REF		
W1	CABLE ASSY #7	406603	89536	406603	1		

Table 5-4. A2 Main PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
W2	CABLE ASSY #8	406645	89536	406645	1		
W3	CABLE ASSY #14	270108	89536	270108	1		
XQ1	CONN	402958	27264	09-52-3030	8		
XQ2	CONN	402958	27264	09-52-3030	REF		
XQ3	CONN	402958	27264	09-52-3030	REF		
XQ4	CONN	402958	27264	09-52-3030	REF		
XQ5	CONN	402958	27264	09-52-3030	REF		
XQ6	CONN	402958	27264	09-52-3030	REF		
XQ7	CONN	402958	27264	09-52-3030	REF		
XQ8	CONN	402958	27264	09-52-3030	REF		
XU24	SOCKET, IC, 16 PIN	370312	01295	C931602	8		
XU26	SOCKET, IC, 24 PIN	376236	91506	324-AG39D	3		
XU27	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
XU28	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
XU29	SOCKET, IC, 40 PIN	376244	91506	340-AG39D	1		
XU30	SOCKET, IC, 24 PIN	376236	91506	324-AG39D	REF		
XU41	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
XU42	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
XU43	SOCKET, IC, 24 PIN	376236	91506	324-AG39D	REF		
XU44	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
XU45	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		

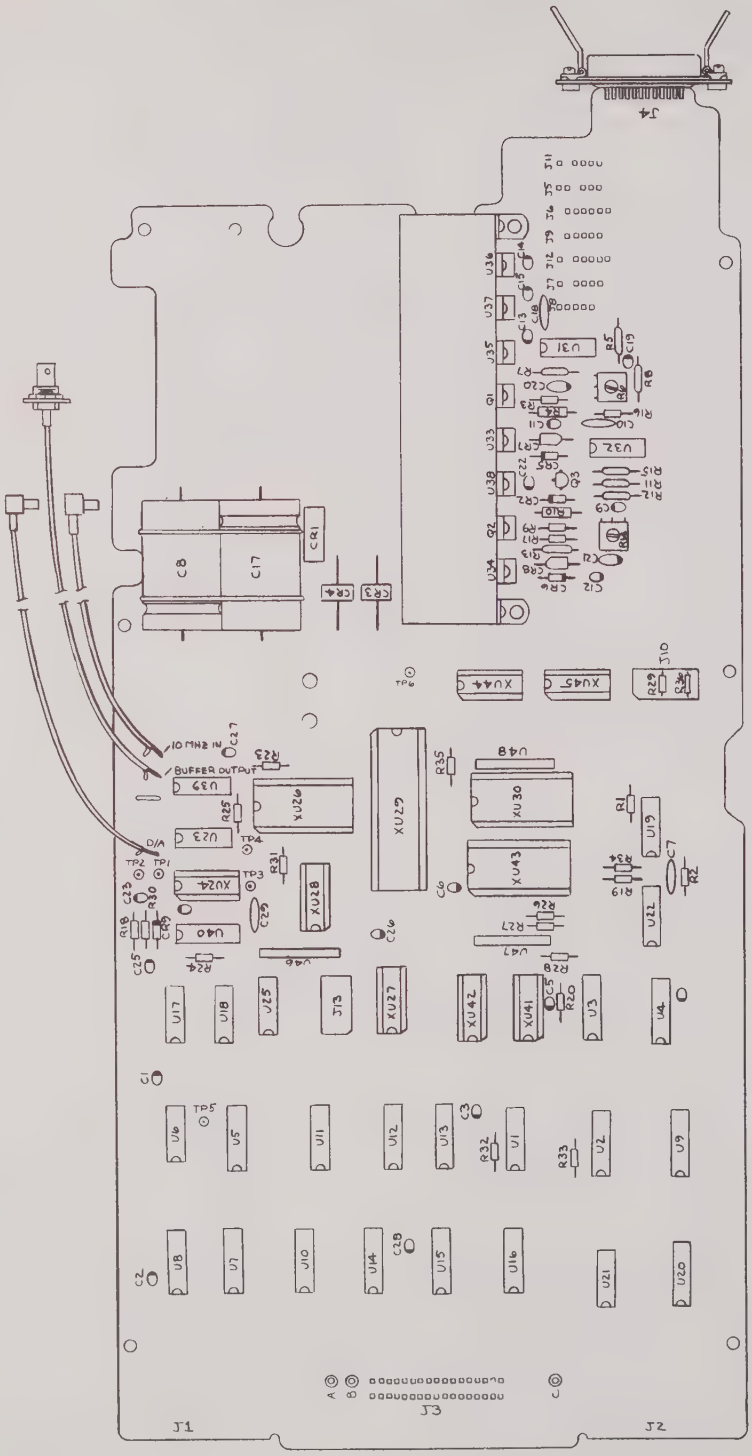

Figure 5-4. Main PCB Assembly

Table 5-5. A3 Input/Output Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3	INPUT/OUTPUT MODULE ASSY FIGURE 5-5 (6011A-4101T)	412635	89536	412635	REF		
A3A1	INPUT/OUTPUT PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	5		
H2	SCREW, PHP, 4-40 X 5/16	152116	73734	19023	1		
H3	SCREW, FHMS UNDERCUT, 4-40 X 5/16	268193	89536	268193	9		
H4	WASHER, SPLIT-LOCK, #4	185710	89536	185710	1		
H5	WASHER, FLAT, #4	146225	86928	5710-18-32	1		
MP1	COVER, INNER	419705	89536	419705	1		
MP2	COVER, OUTER	390559	89536	390559	1		
MP3	COVER, RF SHIELD, TOP, INNER	405969	89536	405969	1		
MP4	COVER, RF SHIELD, TOP, OUTER	405688	89536	405688	1		
MP5	COVER, RF SHIELD, BOTTOM	405696	89536	405696	1		

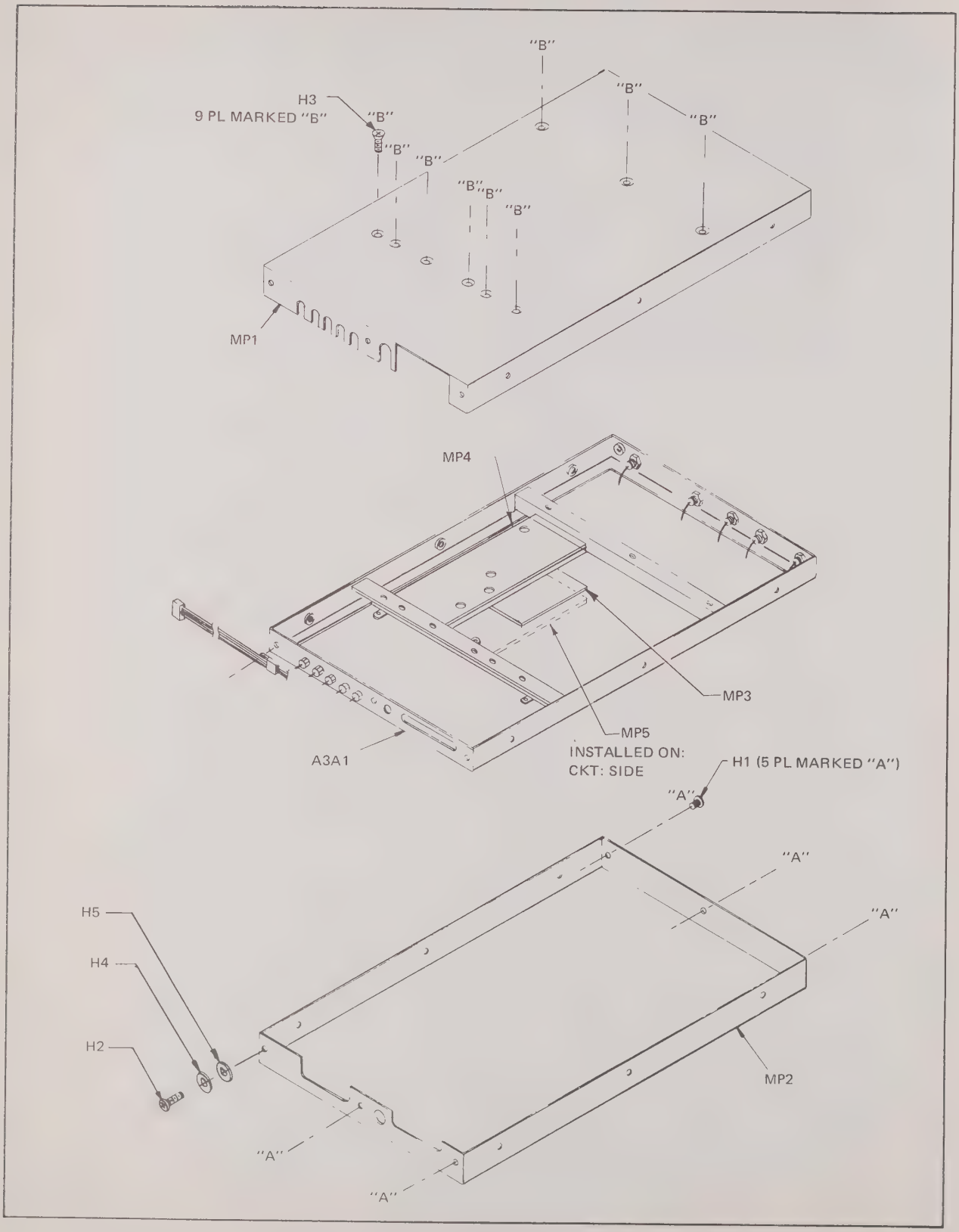

Figure 5-5. Input/Output Module Assembly

Table 5-6. A3A1 Input/Output PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A3A1	INPUT/OUTPUT PCB ASSY	ORDER	NEXT	HIGHER ASSY			
	FIGURE 5-6 (6011A-4001)						
C1	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	21		
C2	CAP, TA, 4.7UF +/-20%, 20V	161943	56289	196D475X0025KA1	3		
C3	CAP, TA, 4.7UF +/-20%, 20V	161943	56289	196D475X0025KA1	REF		
C4	CAP, MICA, 12PF +/-5%, 500V	175224	72136	DM15C120J	2		
C5	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C6	CAP, MICA, 51PF +/-5%, 500V	277210	72136	DM15E510J	1		
C7	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	16		
C8	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	9		
C9	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C10	CAP, MICA, 56PF +/-5%, 500V	148528	72136	DM15F5605	1		
C11	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-050-651M	5		
C12	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C23A1	5		
C13	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C23A1	REF		
C14	CAP, TA, 4.7UF +/-20%, 20V	161943	56289	196D475X0025KA1	REF		
C15	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-050-651M	REF		
C16	CAP, VAR, 1.1UF - 1.5UF, 2000V	218206	32897	530-000	1	1	
C17	CAP, MICA, 430PF +/-5%, 500V	177980	72136	DM15F431J	2		
C18	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C19	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C20	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C21	CAP, TA, 6.8UF +/-20%, 35V	363713	56289	196D685X0035KA1	2		
C22	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C23	CAP, TA, 22UF +/-20%, 25V	394775	56289	196D226X0025TE4	2		
C24	CAP, MICA, 10PF +/-10%, 500V	175216	72136	DM15C100K	2		
C25	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-050-651M	REF		
C26	CAP, TA, 6.8UF +/-20%, 35V	363713	56289	196D685X0035KA1	REF		
C27	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-050-651M	REF		
C28	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C29	CAP, TA, 22UF +/-20%, 25V	394775	56289	196D226X0025TE4	REF		
C30	CAP, MICA, 360PF +/-5%, 500V	325878	72136	DM15F361J	1		
C31	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C32	CAP, VAR, 2-22PF, 100V	369207	73445	C010KA120E	1	1	
C33	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C34	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C35	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C36	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C37	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C38	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C39	CAP, MICA, 130PF +/-5%, 500V	266205	72136	DM15F131J	3		
C40	CAP, 33PF +/-5%, 500V	160317	72136	DM15E330J	2		
C41	CAP, MICA, 220PF +/-5%, 500V	170423	72136	DM15F221J	2		
C42	CAP, MICA, 22PF +/-5%, 500V	148551	72136	DM15C220J	5		
C43	CAP, MICA, 130PF +/-5%, 500V	266205	72136	DM15F131J	REF		
C44	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C23A1	REF		
C45	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C46	CAP, MICA, 110PF +/-1%, 500V	170415	72136	DM15F111F	1		
C47	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C48	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C49	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C23A1	REF		
C50	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C51	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C52	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
C53	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C54	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C55	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C56	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C57	CAP, MICA, 130PF +/-5%, 500V	266205	72136	DM15F131J	REF		
C58	CAP, MICA, 39PF +/-5%, 500V	148544	72136	DM15E390J	2		
C59	CAP, CER, 0.1UF +/-20%, 50V	149146	56289	33C41A3	2		
C60	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C61	CAP, MICA, 270PF +/-5%, 500V	148452	72136	DM15F271J	1		
C62	CAP, MICA, 22PF +/-5%, 500V	148551	72136	DM15C220J	REF		
C63	CAP, MICA, 22PF +/-5%, 500V	148551	72136	DM15C220J	REF		
C64	CAP, MICA, 22PF +/-5%, 500V	148551	72136	DM15C220J	REF		
C65	CAP, MICA, 39PF +/-5%, 500V	148544	72136	DM15E390J	REF		
C66	CAP, MICA, 30PF +/-5%, 500V	340570	72136	DM15E300J	1		
C67	CAP, MICA, 430PF +/-5%, 500V	177980	72136	DM15F431J	REF		
C68	CAP, MICA, 390PF +/-5%, 500V	148437	72136	DM15F391J	2		
C69	CAP, MYLAR, 0.012UF +/-10%, 50V	402883	06001	75FIR5A123	1		
C70	CAP, MYLAR, 0.0033UF +/-10%, 50V	402868	06001	75FIR5A332	1		
C71	CAP, MYLAR, 0.033UF +/-10%, 50V	271841	06001	75FIR5A333	1		
C72	CAP, MYLAR, 0.0015UF +/-10%, 50V	402859	06001	75FIR5A315	1		
C73	CAP, MYLAR, 0.015UF +/-10%, 50V	402891	06001	75FIR5A153	1		
C74	CAP, MICA, 220PF +/-5%, 500V	170423	72136	DM15F221J	REF		
C75	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C76	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C77	CAP, MICA, 10PF +/-10%, 500V	175216	72136	DM15C100K	REF		
C78	CAP, MICA, 5PF +/-10%, 500V	148577	72136	DM15C050K	1		
C79	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C80	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C81	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C82	CAP, MICA, 1000PF +/-5%, 500V	148387	72136	DM19F102J	1		
C83	CAP, MICA, 5000PF +/-5%, 500V	181065	72136	DM19F502J	1		
C84	CAP, MICA, 390PF +/-5%, 500V	148437	72136	DM15F391J	REF		
C85	CAP, MICA, 7500PF +/-5%, 100V	402933	72136	DM19F752J	1		
C86	CAP, MICA, 1200PF +/-5%, 500V	148379	72136	DM19F122J	1		
C87	CAP, MICA, 6800PF +/-2%, 100V	408252	72136	DM19F682G	1		
C88	CAP, MICA, 680PF +/-5%, 500V	148403	72136	DM19F681J	1		
C89	CAP, MICA, 5600PF +/-2%, 100V	182873	72136	DM19F562G	1		
C90	CAP, CER, 0.1UF +/-20%, 50V	149146	56289	33C41A3	REF		
C91	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C92	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C93	CAP, MICA, 47PF +/-5%, 500V	148536	72136	DM15E470J	1		
C94	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C23A1	REF		
C95	CAP, CER, 0.22UF +/-20%, 50V	309849	72982	8131-050-651M	REF		
C96	CAP, CER, 0.0012 +/-10%, 500V	106732	71590	CF122	3		
C97	CAP, CER, 0.0012 +/-10%, 500V	106732	71590	CF122	REF		
C98	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C99	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C100	CAP, CER, 39PF +/-5%, 1000V	417410	72982	858-000-RG2-390J	1		
C101	CAP, MICA, 510PF +/-5%, 500V	148411	72136	DM19E511J	1		
C102	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C103	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C104	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C105	CAP, CER, 0.0012UF +/-20%, 100V	358283	72982	8121-A100-W5R-122M	1		
C106	CAP, PCRBNT, 0.15UF +/-5%, 50V	343616	84411	X463UW151	2		
C107	CAP, PCRBNT, 0.15UF +/-5%, 50V	343616	84411	X463UW151	REF		
C108	CAP, 33PF +/-5%, 500V	160317	72136	DM15E330J	REF		
C110	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C111	CAP, CER, 0.005UF +/-20%, 50V	175232	56289	C023B101E502M	1		
C112	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C113	CAP, FEED THRU, 2500PF, 500V	248286	72982	2499-003X56-252AA	5		
C114	CAP, FEED THRU, 2500PF, 500V	248286	72982	2499-003X56-252AA	REF		
C115	CAP, FEED THRU, 2500PF, 500V	248286	72982	2499-003X56-252AA	REF		
C116	CAP, FEED THRU, 2500PF, 500V	248286	72982	2499-003X56-252AA	REF		
C117	CAP, FEED THRU, 2500PF, 500V	248286	72982	2499-003X56-252AA	REF		
C118	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C119	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C120	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103	REF		
C121	CAP, CER, 0.0012 +/-10%, 500V	106732	71590	CF122	REF		
C122	CAP, MICA, 4PF +/-0.5%, 500V	190397	72136	DM15C040E	1		
C123	CAP, MICA, 200PF +/-5%, 500V	272880	72136	DM15F201J	1		
C124	CAP, MICA, 12PF +/-5%, 500V	175224	72136	DM15C120J	REF		
C125	CAP, MICA, 22PF +/-5%, 500V	148551	72136	DM15C220J	REF		
C126	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	1	1	
C127	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
C128	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D686X0015TE4	REF		
CR1	DIODE, HI-SPEED SW	203323	07910	1N4448	16	4	
CR2	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR3	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR4	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR5	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR6	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR7	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR8	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR9	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR10	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR11	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR12	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR13	DIODE, ZENER, 10V	113324	07910	1N961A	2	1	
CR14	DIODE, ZENER, 20V	180463	07910	1N968B	1	1	
CR15	DIODE, ZENER, 10V	113324	07910	1N961A	REF		
CR16	DIODE, ZENER	249052	07910	1N963B	1	1	
CR17	DIODE, ZENER, 3.9V	113316	07910	1N748	2	1	
CR18	DIODE, ZENER	342527	07910	TD333719	1	1	
CR19	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR20	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR21	DIODE, ZENER, 3.9V	113316	07910	1N748	REF		

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
CR22	DIODE, ZENER, 6.2V	180497	07910	1N753	1	1	
CR23	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR24	DIODE, HI-SPEED SW	203323	07910	1N4448	REF		
CR25	DIODE, ZENER, 5.1V	159798	07910	1N751A	1	1	
H1	SCREW, PHD, 4-40 X 3/8	256164	73734	19024	2		
H2	WASHER, FLAT, #4	381749	89536	381749	2		
H3	WASHER, SPLIT-LOCK, #4	147603	89536	147603	2		
H4	SCREW, PHP, 4-40 X 3/16	129882	73734	19021	3		
H5	WASHER, SPLIT-LOCK, #4	110395	73734	1355	3		
H6	RIVET 1/8 INCH	103424	12014	R3647X5-32	16		
H7	SCREW, PHP, 8-32 X1/4	228890	73734	19062	7		
H9	TIE WRAP	172080	06383	SST-1	2		
H10	CLAMP, CABLE	104406	89536	104406	1		
J1	CONN, SMB	207639	13511	51-049-0000	6		
J2	CONN, SMB	207639	13511	51-049-0000	REF		
J3	CONN, SMB	207639	13511	51-049-0000	REF		
J4	CONN, SMB	207639	13511	51-049-0000	REF		
J5	CONN, SMB	207639	13511	51-049-0000	REF		
J6	CONN, SMB	207639	13511	51-049-0000	REF		
L1	INDUCTOR, CHOKE, 6T	320911	89563	320911	24		
L2	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L3	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L5	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L6	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L7	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L8	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L9	INDUCTOR, 0.27UH	313031	24759	MR-0.27	2		
L10	INDUCTOR, 0.27UH	313031	24759	MR-0.27	REF		
L11	INDUCTOR, 0.56UH	402909	24759	MR-0.56	1		
L12	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L13	INDUCTOR, 10UH	174730	43543	WEE-10	1		
L14	INDUCTOR, RF, 1.4-1.9UH	345850	89563	345850	4		
L15	INDUCTOR, RF, 1.4-1.9UH	345850	89563	345850	REF		
L16	INDUCTOR, RF, 1.4-1.9UH	345850	89563	345850	REF		
L17	INDUCTOR, 39UH	344010	24759	MR-39	1		
L18	INDUCTOR, 47UH	249094	24759	MR-47	1		
L19	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L20	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L21	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L22	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L23	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L24	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L25	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L26	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L27	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L28	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	6		
L29	INDUCTOR, 3.9UH, +/-5%	413864	24759	MR-3.9	1		
L30	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L31	INDUCTOR, 1.5UH +/-5%	413856	24759	MR-1.5	1		
L32	INDUCTOR, RF, 1.4-1.9UH	345850	89563	345850	REF		

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
L33	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L34	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L35	INDUCTOR, 560UH	363150	24759	MR-560	2		
L36	INDUCTOR, 560UH	363150	24759	MR-560	REF		
L37	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L39	INDUCTOR, 680UH	343848	24759	MR-6-80	1		
L40	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L41	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L42	INDUCTOR, 27,000UH	363192	24759	MR-27,000	1		
L43	INDUCTOR, 1200UH	343855	24759	MR-1200	1		
L44	INDUCTOR, 470UH	147827	43543	WEE-470	1		
L45	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
L46	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
L47	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
L48	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
L49	INDUCTOR, 2.2UH	413880	24759	MR-2.2	1		
L50	INDUCTOR, CHOKE, 6T	320911	89563	320911	REF		
L51	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
L52	FERRITE, CORE, 1T	321182	02114	56-590-65-4B	REF		
MP1	MODULE FRAME	390534	89536	390534	1		
MP2	HEATSINK	387860	89536	387860	1		
MP3	SHIELD, RF	405951	89536	405951	1		
MP5	SHIELD, RF	405662	89536	405662	1		
MP6	SHIELD, RF	405670	89536	405670	1		
MP7	SHIELD, RF	405647	89536	405647	1		
MP8	SHIELD, RF	405654	89536	405654	1		
P5	DC, CABLE, ASSY	416594	89536	416594	1		
P9	DC, CABLE ASSY	420034	89536	420034	1		
Q1	XSTR, SI, PNP	195974	04713	2N3906	1	1	
Q2	XSTR, SI, PNP	343012	07263	2N4258	5	1	
Q3	XSTR, SI, PNP	343012	07263	2N4258	REF		
Q4	XSTR, SI, NPN	453431	89536	453431	4	1	
Q5	XSTR, SI, NPN	453431	89536	453431	REF		
Q6	XSTR, SI, PNP	402586	04713	2N2905A	1	1	
Q7	XSTR, SI, PNP	402578	04713	2N5160	1	1	
Q8	XSTR, SI, NPN	407965	04713	2N3553	1	1	
Q9	XSTR, SI, NPN	179374	04713	2N2218	2	1	
Q10	XSTR, SI, PNP	402560	04713	MM4019	1	1	
Q11	XSTR, SI, NPN	402602	04713	MRF531	1	1	
Q12	XSTR, SI, NPN	179374	04713	2N2218	REF		
Q13	XSTR, SI, PNP	229898	04713	MPS6522	2	1	
Q14	XSTR, SI, PNP	218081	04713	MPS6520	3	1	
Q15	XSTR, SI, PNP	343012	07263	2N4258	REF		
Q16	XSTR, SI, NPN	453431	89536	453431	REF		
Q17	XSTR, SI, PNP	343012	07263	2N4258	REF		
Q19	XSTR, SI, NPN	453431	89536	453431	REF		
Q20	XSTR, SI, PNP	343012	07263	2N4258	REF		
Q21	XSTR, SI, PNP	218081	04713	MPS6520	REF		
Q22	XSTR, SI, NPN	333898	04713	MPSH10	2	1	
Q23	XSTR, SI, NPN	333898	04713	MPSH10	REF		

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q24	XSTR, SI, PNP	218081	04713	MPS6520	REF		
Q25	XSTR, FET	428169	07910	02366E	4		
Q26	XSTR, SI, NPN	218396	04713	2N3904	1		1
Q27	XSTR, FET	428169	07910	02366E	REF		
Q28	XSTR, FET	428169	07910	02366E	REF		
Q29	XSTR, SI, NPN	272930	04713	2N5943	1		
Q30	XSTR, SI, PNP	229898	04713	MPS6522	REF		
Q31	XSTR, FET	428169	07910	02366E	REF		
R1	RES, FXD, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	4		
R2	RES, MF, 100 +/-1%, 1/8W	168195	91637	MFF1-8A100F	4		
R3	RES, MF, 100 +/-1%, 1/8W	168195	91637	MFF1-8A100F	REF		
R4	RES, FXD, COMP, 240 +/-5%, 1/4W	221895	01121	CB2415	1		
R5	RES, FXD, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	4		
R6	RES, MF, 453 +/-1%, 1/8W	267393	91637	MFF1-84530F	1		
R7	RES, FXD, COMP 5.6 +/-5%, 1/4W	208033	01121	CB1525	2		
R8	RES, FXD, COMP, 4.7 +/-5%, 1/4W	193359	01121	CB47G5	2		
R9	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	4		
R10	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	REF		
R11	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	6		
R12	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	3		
R13	RES, COMP, 680 +/-5%, 1/2W	178392	01121	EB6815	3		
R14	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	REF		
R15	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	REF		
R16	RES, VAR, CERMET, 50K +/-10%, 1/2W	335778	89536	335778	2		
R17	RES, COMP, 20K +/-5%, 1/4W	221614	01121	CB2035	1		
R18	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	7		
R19	RES, COMP, 430 +/-5%, 1/4W	203869	01121	CB4715	1		
R20	RES, FXD, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R21	RES, FXD, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R22	RES, FXD, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	REF		
R23	RES, COMP, 27 +/-10%, 1/8W	266254	01121	BB2701	1		
R24	RES, COMP, 2.2K +/-5%, 1/2W	108506	01121	EB2225	2		
R25	RES, COMP, 2.2K +/-5%, 1/2W	108506	01121	EB2225	REF		
R26	RES, MF, 402 +/-1%, 1/8W	289611	91637	MFF1-84020F	1		
R27	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	7		
R28	RES, MF, 953 +/-1%, 1/8W	288555	91637	MFF1-89530F	1		
R29	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	REF		
R30	RES, MF, 221 +/-1%, 1/8W	340794	91637	MFF1-82210F	1		
R31	RES, MF, 3.92K +/-1%, 1/8W	294801	91637	MFF1-083921F	1		
R32	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	11		
R33	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	REF		
R34	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R35	RES, COMP, 91 +/-5%, 1/4W	221887	01121	CB9105	1		
R36	RES, MF, 4.02K +/-1%, 1/8W	235325	91637	MFF1-84021F	1		
R37	RES, MF, 732 +/-1%, 1/8W	294884	91637	MFF1-87320F	1		
R38	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R39	RES, FXD, COMP 5.6 +/-5%, 1/4W	208033	01121	CB1525	REF		
R40	RES, COMP, 18 +/-5%, 1/4W	219022	01121	CB1805	1		
R41	RES, COMP, 2.0 +/-5%, 1/2W	218735	01121	EB20G5	2		
R42	RES, COMP, 1K +/-5%, 1/2W	108597	01121	EB1025	2		

Table 5-6. Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R43	RES, COMP, 5.1K +/-5%, 1/4W	193342	01121	CB5125	2		
R44	RES, COMP, 22 +/-5%, 1/4W	147884	01121	CB2205	1		
R45	RES, COMP, 4.3 +/-5%, 1/4W	268912	01121	CB43G5	1		
R46	RES, VAR, CRMT, 100 +/-20%, 1/2W	193052	19701	ET50W101	1	1	
R47	RES, MF, 22.6 +/-1%, 1/8W	296640	91637	MFF1-82286F	1		
R48	RES, COMP, 2.0 +/-5%, 1/2W	218735	01121	EB20G5	REF		
R49	RES, COMP, 1K +/-5%, 1/2W	108597	01121	EB1025	REF		
R50	RES, FXD, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	REF		
R51	RES, FXD, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	REF		
R52	RES, MF, 10 +/-0.25%, 1/4W	424192	91637	MFF1-4A100C	2		
R53	RES, MF, 10 +/-0.25%, 1/4W	424192	91637	MFF1-4A100C	REF		
R54	RES, MF, 100 +/-1%, 1/8W	168195	91637	MFF1-8A100F	REF		
R55	RES, MF, 100 +/-1%, 1/8W	168195	91637	MFF1-8A100F	REF		
R56	RES, MF, 90.9 +/-0.1%, 1/2W	423947	91637	MFF1-290R9B	2		
R57	RES, MF, 90.9 +/-0.1%, 1/2W	423947	91637	MFF1-290R9B	REF		
R58	RES, COMP, 1M +/-5%, 1/4W	182204	01121	CB1055	1		
R59	RES, MF, 24.3 +/-0.5%, 1/8W	236745	91637	MFF1-82432D	2		
R60	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R61	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R62	RES, COMP, 5.1K +/-5%, 1/4W	193342	01121	CB5125	REF		
R63	RES, COMP, 3.0 +/-5%, 1/4W	218040	01121	CB30G5	1		
R64	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R65	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R66	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	REF		
R67	RES, FXD, COMP, 4.7 +/-5%, 1/4W	193359	01121	CB47G5	REF		
R68	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	REF		
R69	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R70	RES, MF, 301 +/-1%, 1/8W	289173	91637	MFF1-83010F	1		
R71	RES, MF, 634 +/-1%, 1/8W	289306	91637	MFF1-86340F	1		
R72	RES, MF, 649+/-1%, 1/8W	309955	91637	MFF1-86490F	1		
R73	RES, MF, 750 +/-1%, 1/8W	289363	91637	MFF1-87510F	1		
R74	RES, MF, 499 +/-1%, 1/8W	168211	91637	MFF1-84990F	1		
R75	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R76	RES, COMP, 5.1 +/-5%, 1/4W	281832	01121	CB51G5	1		
R77	RES, VAR, CRMT, 20 +/-20%, 1/2W	275727	71450	360T200B	2	1	
R78	RES, MF, 732 +/-1%, 1/8W	289355	91637	MFF1-87320F	1		
R79	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	REF		
R80	RES, COMP, 200 +/-5%, 1/4W	193482	01121	CB2015	1		
R81	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R82	RES, MF, 422 +/-1%, 1/8W	288506	91637	MFF1-84220F	2		
R83	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R84	RES, COMP, 680 +/-5%, 1/2W	178392	01121	EB6815	REF		
R85	RES, COMP, 1.8K +/-5%, 1/4W	175042	01121	CB1825	1		
R86	RES, COMP, 27K +/-5%, 1/4W	148148	01121	CB2735	1		
R87	RES, MF, 182 +/-1%, 1/8W	289579	91637	MFF1-81820F	2		
R88	RES, MF, 182 +/-1%, 1/8W	289579	91637	MFF1-81820F	REF		
R89	RES, MF, 3.01K +/-1%, 1/8W	312645	91637	MFF1-83011F	1		
R90	RES, COMP, 150 +/-5%, 1/4W	147934	01121	CB1515	1		
R91	RES, MF, 1.69K +/-1%, 1/8W	321414	91637	MFF1-81691F	2		
R92	RES, VAR, CRMT, 500 +/-10%, 1/2W	325613	71450	360T501A	1	1	

Table 5-6. A3A1 Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R93	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R94	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R95	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R96	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	5		
R97	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R98	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R100	RES, FXD, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R101	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	REF		
R102	RES, COMP, 300 +/-5%, 1/4W	348276	01121	CB3015	2		
R103	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	REF		
R104	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R105	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R106	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	REF		
R107	RES, COMP, 300 +/-5%, 1/4W	348276	01121	CB3015	REF		
R108	RES, COMP, 680 +/-5%, 1/2W	178392	01121	EB6815	REF		
R109	RES, MF, 1.69K +/-1%, 1/8W	321414	91637	MFF1-81691F	REF		
R110	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R111	RES, MF, 301 +/-1%, 1/8W	267740	91637	MFF1-83010F	2		
R112	RES, MF, 24.3 +/-0.5%, 1/8W	236745	91637	MFF1-82432D	REF		
R113	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
R114	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
R115	RES, VAR, CRMT, 1K +/-10%, 1/2W	275750	71450	360T102A	1	1	
R116	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R117	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	2		
R118	RES, MF, 49.9 +/-1%, 1/8W	305896	91637	MFF1-84989F	REF		
R119	RES, COMP, 560K +/-5%, 1/4W	220533	01121	CB5645	2		
R120	RES, COMP, 560K +/-5%, 1/4W	220533	01121	CB5645	REF		
R121	RES, MF, 301 +/-1%, 1/8W	267740	91637	MFF1-83010F	REF		
R122	RES, MF, 100K +/-0.1%, 1/8W	340166	91637	MFF1810033	2		
R123	RES, MF, 100K +/-0.1%, 1/8W	340166	91637	MFF1810033	REF		
R124	RES, MF, 475 +/-1%, 1/8W	320010	91637	MFF1-84750F	1		
R125	RES, MF, 143K +/-1%, 1/8W	291336	91637	MFF1-81433F	1		
R126	RES, VAR, CRMT, 20 +/-20%, 1/2W	275727	71450	360T200B	REF		
R127	RES, MF, 20.0 +/-1%, 1/8W	236844	91637	MFF1-820ROF	1		
R128	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R129	RES, MF, 10.0 +/-1%, 1/8W	268789	91637	MFF1-810ROF	1		
R130	RES, COMP, 62K +/-5%, 1/4W	220053	01121	CB6235	1		
R131	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	2		
R132	RES, MF, 422 +/-1%, 1/8W	288506	91637	MFF1-84220F	REF		
R133	RES, CAR, 360 +/-5%, 1/4W	352286	80031	CR251-45P361T	1		
R134	RES, COMP, 100 +/-5%, 1/4W	193185	01121	CB1015	REF		
R135	RES, COMP, 3.9K +/-5%, 1/4W	148064	01121	CB3925	1		
R136	RES, COMP, 22K +/-5%, 1/4W	148130	01121	CB2235	1		
R137	RES, MF, 51.1 +/-1%, 1/8W	305904	91637	MFF1-851R1F	1		
R138	RES, MF, 68.1 +/-1%, 1/8W	305955	91637	MFF1-868R1F	1		
R139	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	REF		
R140	RES, VAR, 1K +/-20%, 1/4W	193060	19701	ET50W102	1	1	
R141	RES, COMP, 1.5K +/-5%, 1/4W	148031	01121	CB1525	1		
R142	RES, VAR, CERMET, 50K +/-10%, 1/2W	335778	89536	335778	REF		
R143	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		

Table 5-6. Input/Output PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R144	RES, COMP, 12K +/-5%, 1/4W	159731	01121	CB1235	1		
R145	RES, MF, 1.74K +/-1%, 1/8W	344358	91637	MFF1-81741F	1		
R146	RES, VAR, 200 +/-10%, 1/2W	275743	71450	360T201A	1	1	
R147	RES, MF, 1.87K +/-1%, 1/8W	349118	91637	MFF1-81871F	1		
R148	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
R149	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	REF		
R150	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	REF		
R151	RES, COMP, 200 +?-5%, 1/2W	169839	01121	EB2015	1		
R152	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
R153	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
U1	IC, TTL, SCHOTTKY, QUAD 1-INPT NAND GATE	363580	01295	SN74S00N	1	1	
U2	IC, PRESET. DEC/BIN CNTR/LTCH	320747	01295	SN74176N	1	1	
U3	IC, QUAD 2-INPT NAND GATE	293159	01295	SN7490N	1	1	
U4	IC, TTL, HEX INVERTER	292979	01295	SN7404N	1	1	
U5	IC, TTL, DECADE CNTR	402545	01295	SN74LS90N	1	1	
U6	IC, TTL, DUAL 4-BIT DEC/BIN CNTR	402552	01295	SN74390N	1	1	
U7	IC, TTL, RETRIG. MONOSTBLE MULTIVIBRATOR	293134	04713	MC8601P	1	1	
U8	IC, TTL, QUAD 2-INPT NAND GATES	292953	01295	SN7400N	3	1	
U9	IC, TTL, QUAD 2-INPT NAND GATES	292953	01295	SN7400N	REF		
U10	IC, TTL, QUAD 2-INPT NAND GATES	292953	01295	SN7400N	REF		
U11	IC, LIN, OP AMP	413740	12040	LM307N	1	1	
U12	IC, MIXER	434563	89536	434563	1	1	
U13	IC, LIN, 5 XSTR ARRAY	248906	95303	CA3046	1	1	
U14	OSCILLATOR, TC/VCXO	381707	75378	010-0710-0	1	1	
U15	IC, OP AMP	271502	12040	LM301A	1	1	
U16	IC KIT(U16,C126,C127,R113,R114,R148,R152	409888	89536	409888	REF		
U17	IC, LIN, OP AMP	413732	12040	LM308N	1	1	
U18	IC, OP AMP	329912	12040	LM318H	1	1	
W1	CABLE ASSY, RF	411751	89536	411751	1		
W2	CABLE, RF	190322	70903	8269	1		
XQ6	HEATSINK	407270	13103	P1116B	4		
XQ7	HEATSINK	447524	05820	260-4TH5B	3		
XQ8	HEATSINK	407270	13103	P1116B	REF		
XQ9	HEATSINK	447524	05820	260-4TH5B	REF		
XQ10	HEATSINK	407270	13103	P1116B	REF		
XQ11	HEATSINK	447524	05820	260-4TH5B	REF		
XQ12	HEATSINK	407270	13103	P1116B	REF		
XU12	SOCKET, IC	370304	01295	C931402	2		
XU16	SOCKET, IC	370304	01295	C931402	REF		
XU17	IC SOCKET	386144	00779	3-332070-4	6		
XU18	IC SOCKET	386144	00779	3-332070-4	REF		
XU19	IC SOCKET	386144	00779	3-332070-4	REF		
XU20	IC SOCKET	386144	00779	3-332070-4	REF		
XU21	IC SOCKET	386144	00779	3-332070-4	REF		
XU22	IC SOCKET	386144	00779	3-332070-4	REF		

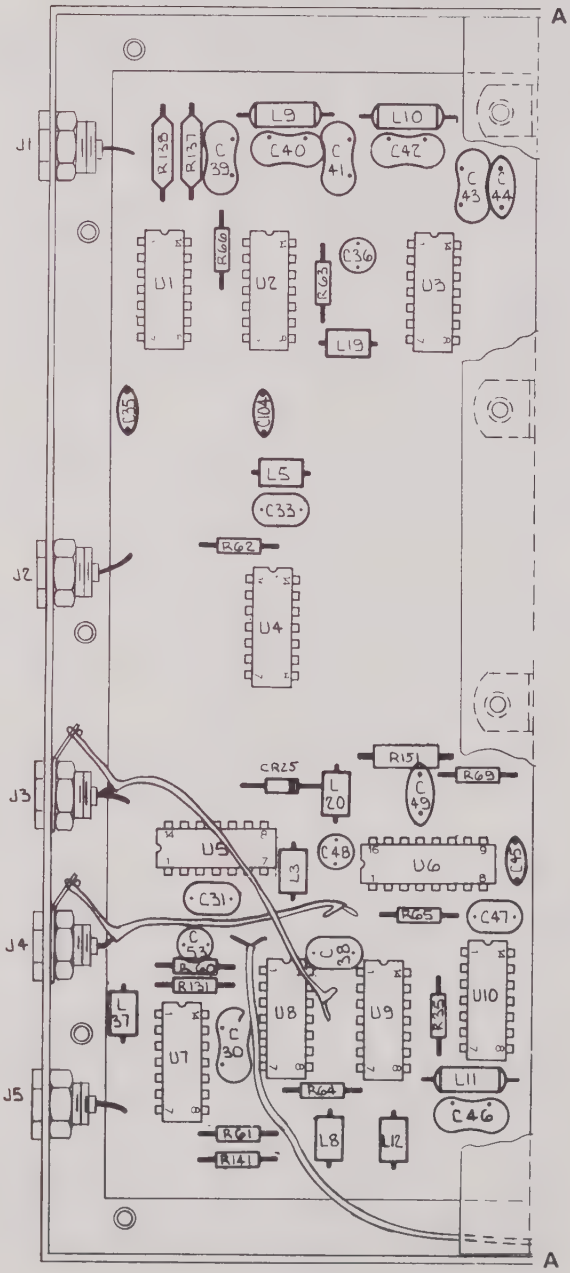

Figure 5-6. Input/Output PCB Assembly

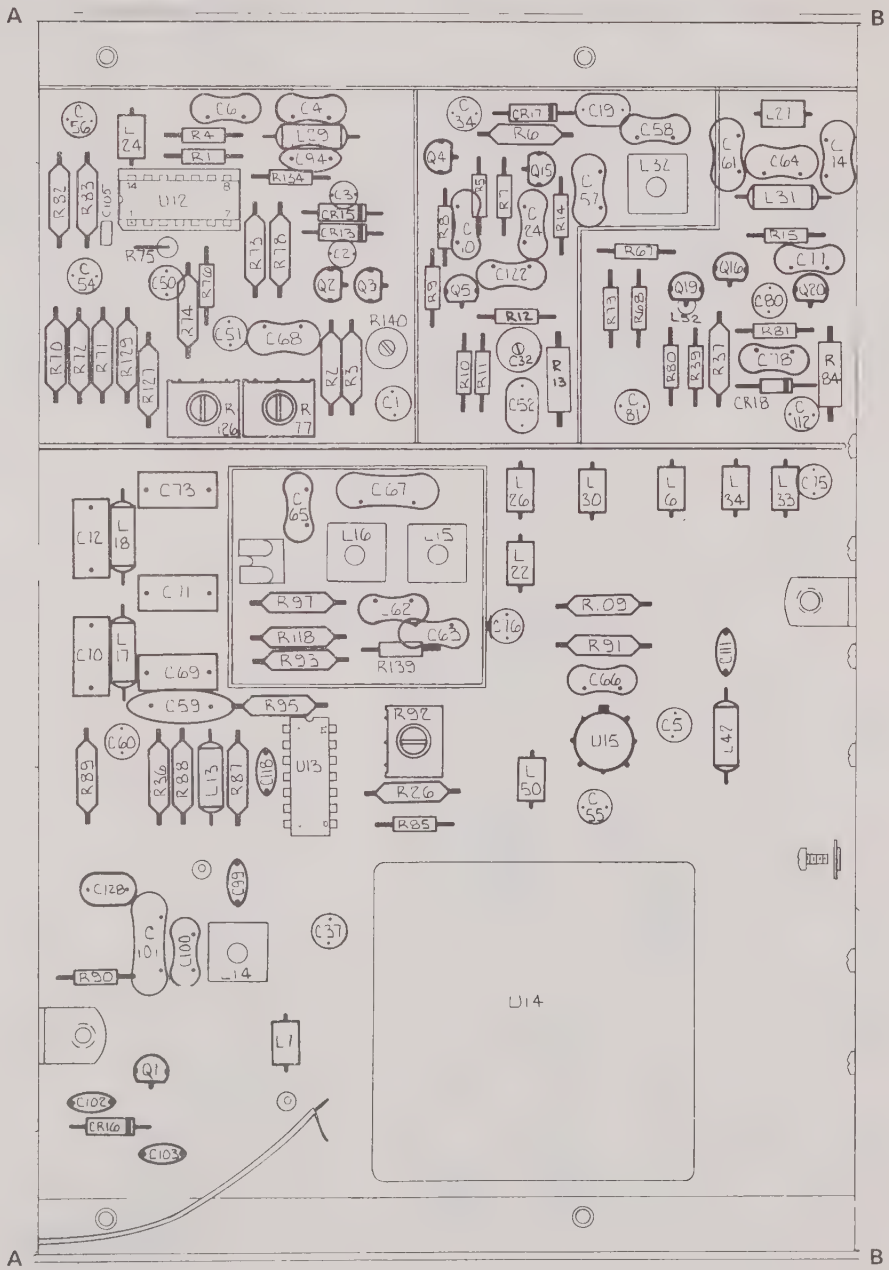

Figure 5-6. Input/Output PCB Assembly (cont)

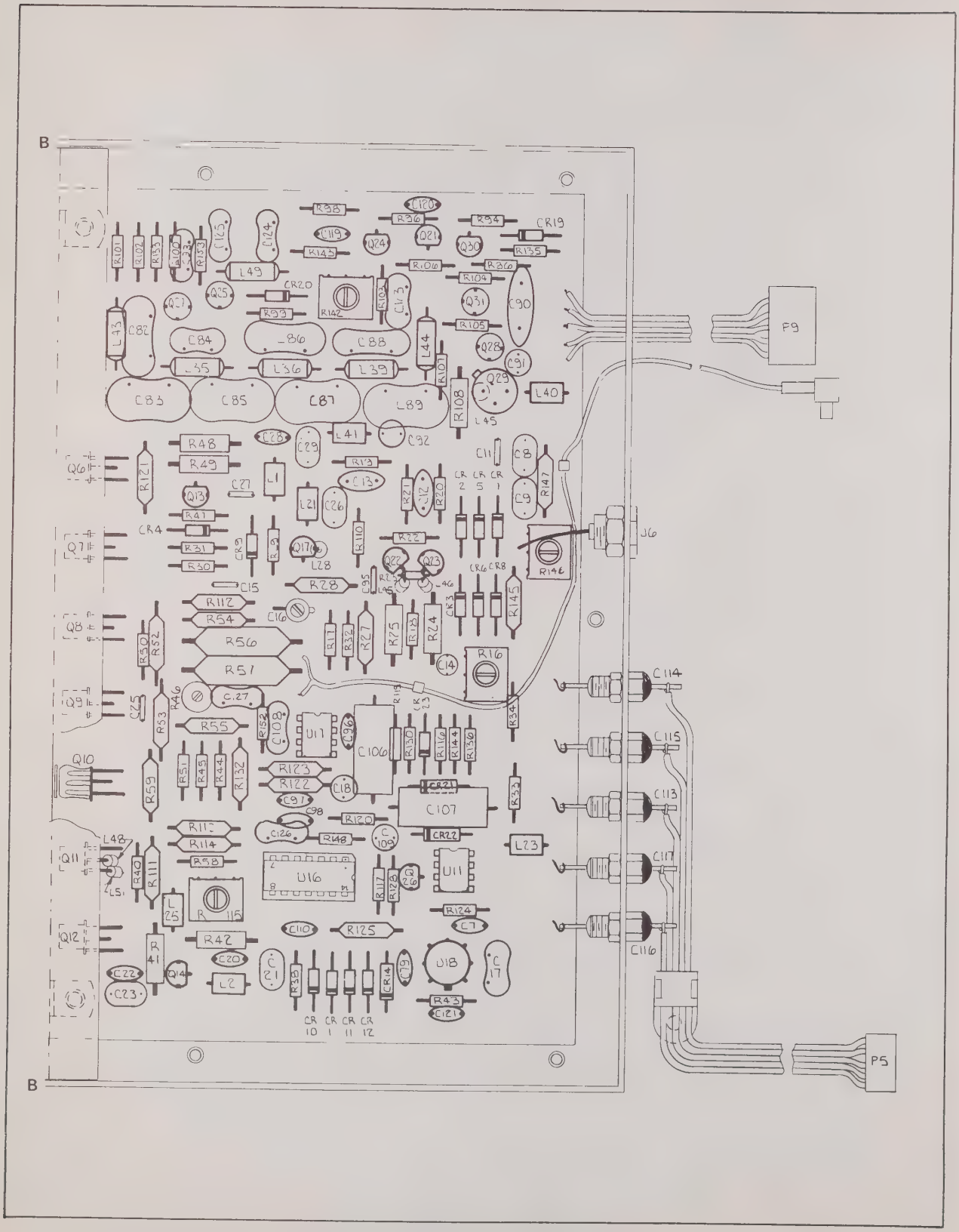

Figure 5-6. Input/Output PCB Assembly (cont)

Table 5-7. A4 Six-Digit Generator Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A4	SIX DIGIT GENERATOR MODULE ASSY FIGURE 5-7 (6010A-4102T)	388058	89536	388058	REF		
A4A1	SIX DIGIT GENERATOR PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	TAPE, FOAM	330449	52152	4508			
H2	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	5		
H3	SCREW, PHP, 4-40 X 5/16	152116	73734	19023	1		
H4	SCREW, FHP, 4-40 X 5/16	268193	89536	268193	4		
H5	SCREW, 4-40 X 1/4	185918	89536	185918	3		
H6	WASHER, SPLIT-LOCK, #4	185710	89536	185710	1		
H7	WASHER, FLAT, #4	146225	86928	5710-18-32	1		
MP1	COVER, INNER	416420	89536	416420	1		
MP2	COVER, OUTER	390559	89536	390559	1		
MP3	SHIELD, MAGNETIC	390922	89536	390922	1		
MP4	SHIELD, RF	405175	89536	405175	1		
MP5	SHIELD, RF, TOP COVER	405548	89536	405548	1		
MP6	SHIELD, RF, BOTTOM COVER	405555	89536	405555	1		

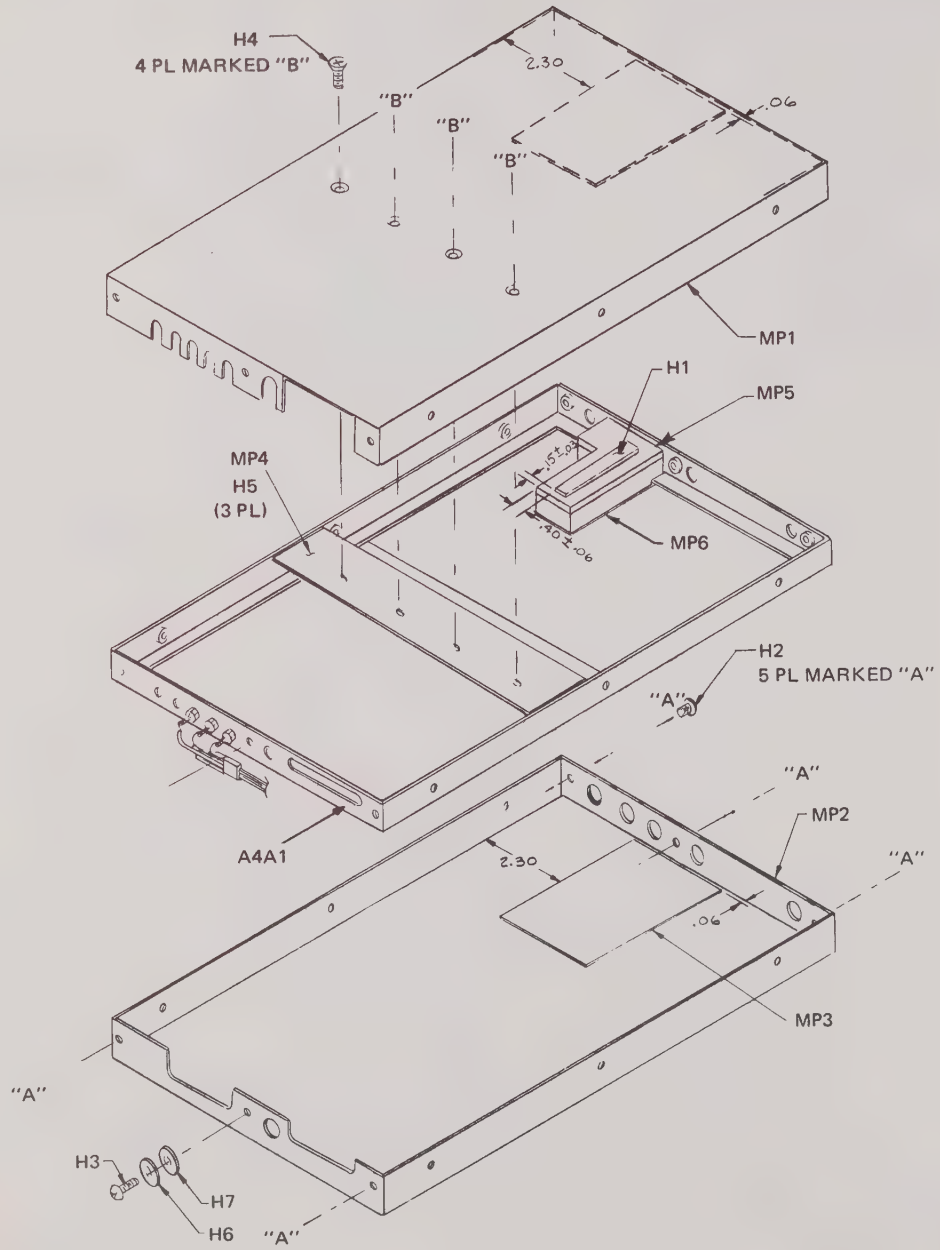

Figure 5-7. A4 Six-Digit Generator Module Assembly

Table 5-8. A4A1 Six-Digit Generator PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A4A1	SIX-DIGIT GENERATOR PCB ASSY FIGURE 5-8 (6010A-4002)	ORDER	NEXT	HIGHER ASSY			
C1	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	25		
C2	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	37		
C4	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C5	CAP, MICA, 1000PF +/-5%, 500V	148387	72136	DM19F102J	3		
C6	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C7	CAP, MICA, 360PF +/-5%, 500V	325878	72136	DM15F361J	1		
C8	CAP, MICA, 1200PF +/-5%, 500V	148379	72136	DM19F122J	2		
C9	CAP, MICA, 390PF +/-5%, 500V	148437	72136	DM15F391J	3		
C10	CAP, MICA, 1200PF +/-5%, 500V	148379	72136	DM19F122J	REF		
C11	CAP, MICA, 18PF +/-5%, 500V	266585	72136	DM15C180J	1		
C12	CAP, MICA, 390PF +/-5%, 500V	148437	72136	DM15F391J	REF		
C13	CAP, CER, 300PF +/-10%, 500V	105734	71590	BB60301KW7W	1		
C14	CAP, MICA, 33PF +/-5%, 500V	160317	72136	DM15E330J	3		
C15	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C16	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C17	CAP, PLSTC, 0.033UF +/-10%, 250V	234492	73445	C280MAE/A33K	1		
C18	CAP, TA, 47UF +/-20%, 20V	348516	56289	196D475X0020TE4	1		
C19	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C21	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C22	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C23	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C24	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C25	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C26	CAP, CER, 0.05UF +/-20%, 50V	149161	56289	55C32A	1		
C27	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C28	CAP, MICA, 1300PF +/-5%, 500V	182881	72136	DM19F132J	1		
C29	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C30	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C31	CAP, MICA, 1000PF +/-5%, 500V	148387	72136	DM19F102J	REF		
C32	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C33	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C34	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C35	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C36	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	2		
C37	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C38	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C39	CAP, MICA, 82PF +/-5%, 500V	148502	72136	DM15E820J	2		
C40	CAP, MICA, 150PF +/-5%, 500V	148478	72136	DM15F151J	2		
C41	CAP, MICA, 150PF +/-5%, 500V	148478	72136	DM15F151J	REF		
C42	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C43	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C44	CAP, MICA, 1000PF +/-5%, 500V	148387	72136	DM19F102J	REF		
C45	CAP, MICA, 33PF +/-5%, 500V	160317	72136	DM15E330J	REF		
C46	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C47	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C48	CAP, PLSTC, 0.027UF +/-10%, 250V	267120	73445	C280MAE/A27K	3		
C49	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C50	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C51	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C52	CAP, MICA, 82PF +/-5%, 500V	148502	72136	DM15E820J	REF		
C53	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C54	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C55	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C56	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C57	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C58	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C59	CAP, MICA 91PF +/-5%, 500V	277228	72136	DM15E910J	2		
C60	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C61	CAP, MICA 91PF +/-5%, 500V	277228	72136	DM15E910J	REF		
C62	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	6		
C63	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C64	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C65	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C66	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C67	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C68	CAP, MICA, 1500PF +/-5%, 500V	148361	72136	DM19F152J	5		
C69	CAP, MICA, 200PF +/-5%, 500V	272880	72136	DM15F201J	2		
C70	CAP, MICA, 390PF +/-5%, 500V	148437	72136	DM15F391J	REF		
C71	CAP, PLSTC, 0.015UF +/-10%, 200V	182154	14655	DMF2S15	1		
C72	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C73	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C74	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C75	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C76	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C77	CAP, MICA, 1500PF +/-5%, 500V	148361	72136	DM19F152J	REF		
C78	CAP, MICA, 270PF +/-5%, 500V	148452	72136	DM15F271J	1		
C79	CAP, MICA, 1500PF +/-5%, 500V	148361	72136	DM19F152J	REF		
C80	CAP, MICA, 200PF +/-5%, 500V	272880	72136	DM15F201J	REF		
C81	CAP, MICA, 430PF +/-5%, 500V	177980	72136	DM15F431J	1		
C82	CAP, CER, 0.0012UF +/-10%, 500V	106732	71590	CF122	REF		
C83	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C84	CAP, MICA, 33PF +/-5%, 500V	160317	72136	DM15E330J	REF		
C85	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C86	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C87	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C88	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C89	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C90	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C91	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C92	CAP, CER, 2200PF +/-10%, 500V	268425	72982	851-000-Z5R-222K	1		
C93	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C94	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	196D226X0020HA1	REF		
C95	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C96	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C97	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C98	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C99	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D685X0015TE4	2		
C100	CAP, TA, 68UF +/-20%, 15V	193615	56289	196D685X0015TE4	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C101	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C102	CAP, TA, 1UF +/-20%, 35V	161919	56289	196D105X0035HA1	1		
C103	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C104	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C105	CAP, MICA, 1500PF +/-5%, 500V	148361	72136	DM19F152J	REF		
C107	CAP, MICA, 1500PF +/-5%, 500V	148361	72136	DM19F152J	REF		
C110	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C111	CAP, PLSTC, 0.027UF +/-10%, 250V	267120	73445	C280MAE/A27K	REF		
C112	CAP, PLSTC, 0.027UF +/-10%, 250V	267120	73445	C280MAE/A27K	REF		
C113	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C114	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C115	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C116	CAP, FEED THRU, 2500PF	248236	72982	2499-003X56-252AA	3		
C117	CAP, FEED THRU, 2500PF	248236	72982	2499-003X56-252AA	REF		
C118	CAP, FEED THRU, 2500PF	248236	72982	2499-003X56-252AA	REF		
C119	CAP, MICA, 480PF +/-1%, 500V	182931	72136	DM19E481F	1		
CR1	DIODE, MATCHED PAIR	347534	04713	MV109M	1	1	1
CR2	DIODE, MATCHED PAIR	347534	04713	MV109M	REF		1
CR3	DIODE, HI-SPD SW	203323	07910	1N4448	4	1	
CR4	DIODE, HI-SPD SW	203323	07910	1N4448	REF		
CR5	DIODE, HI-SPD SW	203323	07910	1N4448	REF		
CR7	DIODE, MATCHED PAIR	347534	04713	MV109M	1	1	2
CR8	DIODE, GE	149187	93332	1N270	1	1	
CR9	DIODE, HI-SPD SW	203323	07910	1N4448	REF		
CR10	DIODE, MATCHED PAIR	347534	04713	MV109M	REF		2
CR12	DIODE	363812	04713	MV109TYPE	1	1	
H1	RIVET	103424	12014	R3647X5-32	16		
H2	TAPE, FOAM	330043	52152	4516	1		
H3	CABLE CLAMP	104406	91506	TA1SA	1		
H4	SOLDER LUG	167015	73734	118100	1		
J1	CONNECTOR, MALE	207639	13511	27-875	4		
J2	CONNECTOR, MALE	207639	13511	27-875	REF		
J3	CONNECTOR, MALE	207639	13511	27-875	REF		
J4	CONNECTOR, MALE	207639	13511	27-875	REF		
L1	CHOKE, RF, BEAD, 6T	320911	89536	320911	18		
L2	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L3	INDUCTOR, 6800UH	363184	24759	MR-6800	3		
L4	INDUCTOR, 6800UH	363184	24759	MR-6800	REF		
L5	INDUCTOR, 6800UH	363184	24759	MR-6800	REF		
L6	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L7	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L8	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L9	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L10	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L11	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L12	CHOKE, RF, 1000UH	147819	72259	WEE-1000	1		
L13	CHOKE, RF, 22UH	147843	72259	WEE-22	3		
L14	CHOKE, RF, 22UH	147843	72259	WEE-22	REF		
L15	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L16	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
L17	CHOKE, RF, 470UH	147827	72259	WEE-470	1		
L18	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L19	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L20	INDUCTOR, 39,000UH	363200	24759	MR-39,000	1		
L21	INDUCTOR, 27,000UH	363192	24759	MR-27,000	1		
L22	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L23	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L24	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L25	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L26	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L27	CHOKE, RF, 22UH	147843	72259	WEE-22	REF		
L32	CHOKE, RF, BEAD, 6T	320911	89536	320911	REF		
L33	FERRITE, TUBE	321182	02114	56-590-65-4B	2		
L34	INDUCTOR, 100UH	363226	24759	MR-100,000	1		
L35	FERRITE, TUBE	321182	02114	56-590-65-4B	REF		
MP1	BUMPER	358341	52152	SJ5003	3		
MP2	RF SHIELD	405530	89536	405530	1		
MP3	FRAME, MODULE	390534	89536	390534	1		
P11	CABLE, DC	416602	89536	416602	1		
P14	CONN, FLT, CABLE	325910	34359	3424	1		
P15	CONNECTOR	295337	89536	295337	1		
P16	CONNECTOR	295329	89536	295329	1		
P17	CONNECTOR (NOT SHOWN)	291815	89536	291815	1		
Q3	XSTR, SI, NPN	248351	04713	MPS918	15	3	
Q4	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q5	XSTR, SI, NPN	218396	04713	2N3904	7	2	
Q7	XSTR, SI, PNP	229898	04713	MPS6522	1	1	
Q8	XSTR, SI, PNP	226290	04713	MPS3640	5	1	
Q9	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q12	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q13	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q14	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q15	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q16	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q17	XSTR, SI, PNP	226290	04713	MPS3640	REF		
Q18	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q19	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q21	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q22	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q23	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q24	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q25	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q26	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q27	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q30	XSTR, SI, PNP	226290	04713	MPS3640	REF		
Q31	XSTR, SI, PNP	226290	04713	MPS3640	REF		
Q36	XSTR, SI, PNP	226290	04713	MPS3640	REF		
Q37	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q38	XSTR, SI, NPN	248351	04713	MPS918	REF		
Q39	XSTR, SI, NPN	248351	04713	MPS918	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R1	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	11		
R3	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	6		
R4	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	3		
R5	RES, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	3		
R6	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R7	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	4		
R8	RES, COMP, 3K+/-5%, 1/4W	193508	01121	CB3025	3		
R9	RES, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R10	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	10		
R11	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R12	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4705	2		
R13	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	2		
R14	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R15	RES, COMP, 820K +/-5%, 1/4W	220541	01121	CB8245	1		
R16	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R17	RES, COMP, 3.9K +/-5%, 1/4W	148064	01121	CB3925	3		
R18	RES, MF, 3.92K +/-1%, 1/8W	294801	01121	MFF1-83921F	1		
R19	RES, MF, 3.83K +/-1%, 1/8W	235143	91637	MFF1-83231F	1		
R20	RES, COMP, 62 +/-5%, 1/4W	261842	01121	CB6205	1		
R21	RES, MF, 750 +/-1%, 1/8W	312801	91637	MFF1-87510F	1		
R22	RES, MF, 9.09K +/-1%, 1/8W	221663	91637	MFF1-89091F	1		
R23	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	6		
R24	RES, COMP, 560 +/-5%, 1/4W	147991	01121	CB5615	1		
R28	RES, COMP, 51 +/-5%, 1/4W	221879	01121	CB5105	1		
R30	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R31	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	REF		
R32	RES, COMP, 3K+/-5%, 1/4W	193508	01121	CB3025	REF		
R33	RES, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R34	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R35	RES, COMP, 300 +/-5%, 1/4W	348276	01121	CB3015	1		
R36	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R37	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	REF		
R38	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	REF		
R39	RES, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	2		
R40	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R41	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R42	RES, COMP, 15K +/-5%, 1/4W	148114	01121	CB1335	2		
R44	RES, COMP, 680 +/-5%, 1/4W	148007	01121	CB6815	1		
R45	RES, COMP, 2M +/-5%, 1/4W	268771	01121	CB2055	1		
R46	RES, COMP, 30K +/-5%, 1/4W	193417	01121	CB3035	1		
R47	RES, COMP, 7.5K +/-5%, 1/4W	193326	01121	CB7525	3		
R48	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	2		
R49	RES, COMP, 9.1K +/-5%, 1/4W	193318	01121	CB9125			
R50	RES, COMP, 3.9K +/-5%, 1/4W	148064	01121	CB3925	REF		
R51	RES, COMP, 12K +/-5%, 1/4W	159731	01121	CB1235	1		
R52	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	1		
R53	RES, COMP, 120K +/-5%, 1/4W	193458	01121	CB1245	1		
R56	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R57	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	REF		
R58	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R59	RES, COMP, 3.3K +/-5%, 1/4W	148056	01121	CB3325	2		
R61	RES, COMP, 150 +/-5%, 1/4W	147934	01121	CB1515	1		
R62	RES, COMP, 180 +/-5%, 1/4W	147942	01121	CB1815	2		
R63	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R64	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	REF		
R65	RES, COMP, 10 +/-5%, 1/4W	147868	01121	CB1005	REF		
R66	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	REF		
R67	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R68	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	REF		
R69	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R70	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R71	RES, COMP, 15K +/-5%, 1/4W	148114	01121	CB1335	REF		
R73	RES, COMP, 750 +/-5%, 1/4W	218024	01121	CB7515	2		
R74	RES, COMP, 13K +/-5%, 1/4W	221598	01121	CB1335	1		
R75	RES, COMP, 1M +/-5%, 1/4W	182204	01121	CB1045	1		
R79	RES, COMP, 3.3K +/-5%, 1/4W	148056	01121	CB3325	REF		
R80	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R81	RES, COMP, 510 +/-5%, 1/4W	218032	01121	CB5115	REF		
R82	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R83	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R84	RES, MF, 13K +/-1%, 1/8W	335539	91637	MFF1-81302F	1		
R85	RES, COMP, 3.9K +/-5%, 1/4W	148064	01121	CB3925	REF		
R86	RES, COMP, 820 +/-5%, 1/4W	148015	01121	CB8215	REF		
R87	RES, MF, 20K +/-1%, 1/8W	291872	01637	MFF1-82002F	1		
R88	RES, COMP, 27K +/-5%, 1/4W	148148	01121	CB2735	1		
R89	RES, MF, 1.3K +/-1%, 1/8W	343921	91637	MFF1-81301F	1		
R90	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R92	RES, MF, 2.67K +/-1%, 1/8W	289587	91637	MFF1-82671F	1		
R93	RES, COMP, 6.2K +/-5%, 1/4W	221960	01121	CB6255	1		
R94	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R95	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R96	RES, COMP, 7.5K +/-5%, 1/4W	193326	01121	CB7525	REF		
R97	RES, COMP, 220 +/-5%, 1/4W	147959	01121	CB2215	1		
R98	RES, COMP, 180 +/-5%, 1/4W	147942	01121	CB1815	REF		
R99	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R100	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R101	RES, COMP, 3K+/-5%, 1/4W	193508	01121	CB3025	REF		
R102	RES, COMP, 100 +/-5%, 1/4W	147926	01121	CB1015	REF		
R103	RES, COMP, 100 +/-10%, 1/8W	261826	01121	BB1015	1		
R104	RES, COMP, 2K +/-5%, 1/4W	202879	01121	CB2025	REF		
R107	RES, COMP, 4.3K +/-5%, 1/4W	193375	01121	CB4325	1		
R108	RES, COMP, 4.7K +/-5%, 1/4W	148072	01121	CB4525	1		
R109	RES, COMP, 2.4M +/-5%, 1/4W	221945	01121	CB2455	1		
R110	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4705	REF		
R111	RES, COMP, 1.6K +/-5%, 1/4W	266197	01121	CB1625	1		
R112	RES, COMP, 1.2K +/-5%, 1/4W	190371	01121	CB1225	REF		
R114	RES, COMP, 2.4K +/-5%, 1/4W	193433	01121	CB2425	1		
R115	RES, COMP, 7.5K +/-5%, 1/4W	193326	01121	CB7525	REF		
R116	RES, COMP, 750 +/-5%, 1/4W	218024	01121	CB7515	REF		
R117	RES, COMP, 39 +/-5%, 1/4W	193391	01121	CB3905	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R118	RES, COMP, 33 +/-5%, 1/4W	175034	01121	CB3305	1		
R119	RES, COMP, 22 +/-5%, 1/4W	147884	01121	CB2205	1		
T1	COIL, RF	345850	89536	345850	4		
T2	COIL, RF	345850	89536	345850	REF		
T3	COIL, RF	345850	89536	345850	REF		
T4	COIL, RF	345850	89536	345850	REF		
T5	XFMR	339234	89536	339234	1		
U1	IC, DIG, HI-SPEED HEX INVERTER	407551	18324	N8T93A	5	1	
U2	IC, DIG, TTL, HEX INVERTER	352039	01295	SN74L04N	2	1	
U3	IC, DIG, TTL, SCHOTTKY QUAD 2-INPUT NAND	363580	01295	SN74S00N	1	1	
U4	IC, DIG, TTL, HEX INVERTER	352039	01295	SN74L04N	REF		
U5	IC, TTL, HI-SPD 3-INPUT POS AND GATE	340448	01295	SN74H11N	2	1	
U6	IC, TTL, 50MHZ DECADE, COUNTER	320754	01295	SN74196N	3	1	
U7	IC, DIG, TTL, QUAD 2-INPUT POS NAND GATE	292961	01295	SN7403N	1	1	
U8	IC, TTL, 50MHZ DECADE, COUNTER	320754	01295	SN74196N	REF		
U9	IC, TTL, J-K EDGE-TRIG F/F, AND INPT	293092	01295	SN74H102N	4	1	
U10	IC, TTL, DUAL J-K EDGE-TRIG F/F	293100	01295	SN74H106N	4	1	
U11	IC, TTL, J-K EDGE-TRIG F/F, AND INPT	293092	01295	SN74H102N	REF		
U12	IC, TTL, DUAL J-K EDGE-TRIG F/F	293100	01295	SN74H106N	REF		
U13	IC, OP AMP	271502	12040	LM301A	3	1	
U14	IC, TTL, PHASE FREQUENCY DETECTOR	320721	04713	MC4044P	5	1	
U15	IC, DIG, TTL, MSI, DECADE COUNTER	293159	01295	SN7490N	5	1	
U16	IC, DIG, TTL, QUAD 2-INPUT POS NAND GATE	292953	01295	SN7400N	1	1	
U18	IC, DIG, HI-SPEED HEX INVERTER	407551	18324	N8T93A	REF		
U19	IC, LINEAR DOUBLE BALANCED MIXER	363762	01295	SN76514N	2	1	
U21	IC, TTL, PHASE FREQUENCY DETECTOR	320721	04713	MC4044P	REF		
U22	IC, DIG, TTL, MSI, DECADE COUNTER	293159	01295	SN7490N	REF		
U23	IC, OP AMP	271502	12040	LM301A	REF		
U24	IC, DIG, TTL, MSI, DECADE COUNTER	293159	01295	SN7490N	REF		
U25	IC, DIG, HI-SPEED HEX INVERTER	407551	18324	N8T93A	REF		
U26	IC, LINEAR DOUBLE BALANCED MIXER	363762	01295	SN76514N	REF		
U28	IC, TTL, PHASE FREQUENCY DETECTOR	320721	04713	MC4044P	REF		
U29	IC, DIG, TTL, MSI, DECADE COUNTER	293159	01295	SN7490N	REF		
U30	IC, DIG, HI-SPEED HEX INVERTER	407551	18324	N8T93A	REF		
U32	IC, TTL, MSI, DECADE, COUNTER HI-SPEED	348250	01295	N8290A	1	1	
U33	IC, TTL, J-K EDGE-TRIG F/F, AND INPT	293092	01295	SN74H102N	REF		
U34	IC,TTL,50MHZ PRESET. DEC.&BIN. CTR/LTCH	320770	01295	SN74197N	2	1	
U35	IC, TTL, DUAL J-K EDGE-TRIG F/F	293100	01295	SN74H106N	REF		
U36	IC, TTL, DUAL J-K EDGE-TRIG F/F	293100	01295	SN74H106N	REF		
U37	IC, OP AMP	271502	12040	LM301A	REF		
U38	IC, TTL, PHASE FREQUENCY DETECTOR	320721	04713	MC4044P	REF		
U39	IC, TTL, DUAL D-TYPE EDGE-TRIG F/F	310227	01295	SN7474N	1	1	
U42	IC, DIG, TTL, MSI, DECADE COUNTER	293159	01295	SN7490N	REF		
U44	IC, DIG, HI-SPEED HEX INVERTER	407551	18324	N8T93A	REF		
U45	IC, TTL, SCHOTKY PRESET. DEC.&BIN. CNTR	472860	18324	82S90N	1		
U46	IC, TTL, 50MHZ DECADE, COUNTER	320754	01295	SN74196N	REF		
U47	IC, TTL, HI-SPD 3-INPUT POS AND GATE	340448	01295	SN74H11N	REF		
U48	IC, TTL, J-K EDGE-TRIG F/F, AND INPT	293092	01295	SN74H102N	REF		
U49	IC,TTL,50MHZ PRESET. DEC.&BIN. CTR/LTCH	320770	01295	SN74197N	REF		
U50	IC, TTL, PHASE FREQUENCY DETECTOR	320721	04713	MC4044P	REF		

Table 5-8. Six-Digit Generator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
W1	CABLE, COAX (NOT SHOWN)	190322	70903	8269	1		
XU1	SOCKET, IC, 14 PIN	370304	01295	C931402	5		
XU2	SOCKET, IC, 14 PIN	370304	01295	C931402	REF		
XU3	SOCKET, IC, 14 PIN	370304	01295	C931402	REF		
XU4	SOCKET, IC, 14 PIN	370304	01295	C931402	REF		
XU5	SOCKET, IC, 14 PIN	370304	01295	C931402	REF		

CR1 AND CR2 ARE A MATCHED PAIR

CR7 AND CR10 ARE A MATCHED PAIR

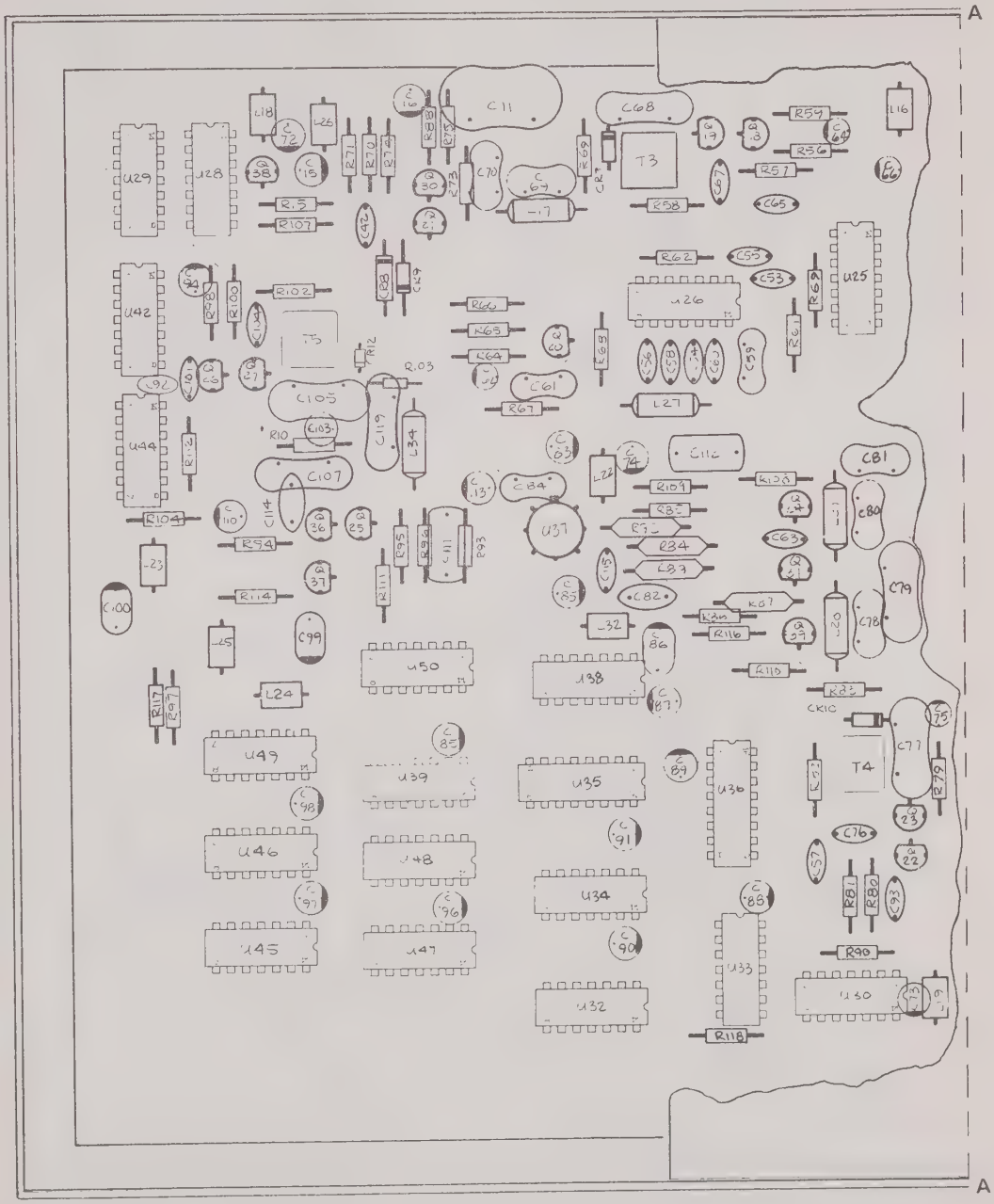

Figure 5-8. Six-Digit Generator PCB Assembly

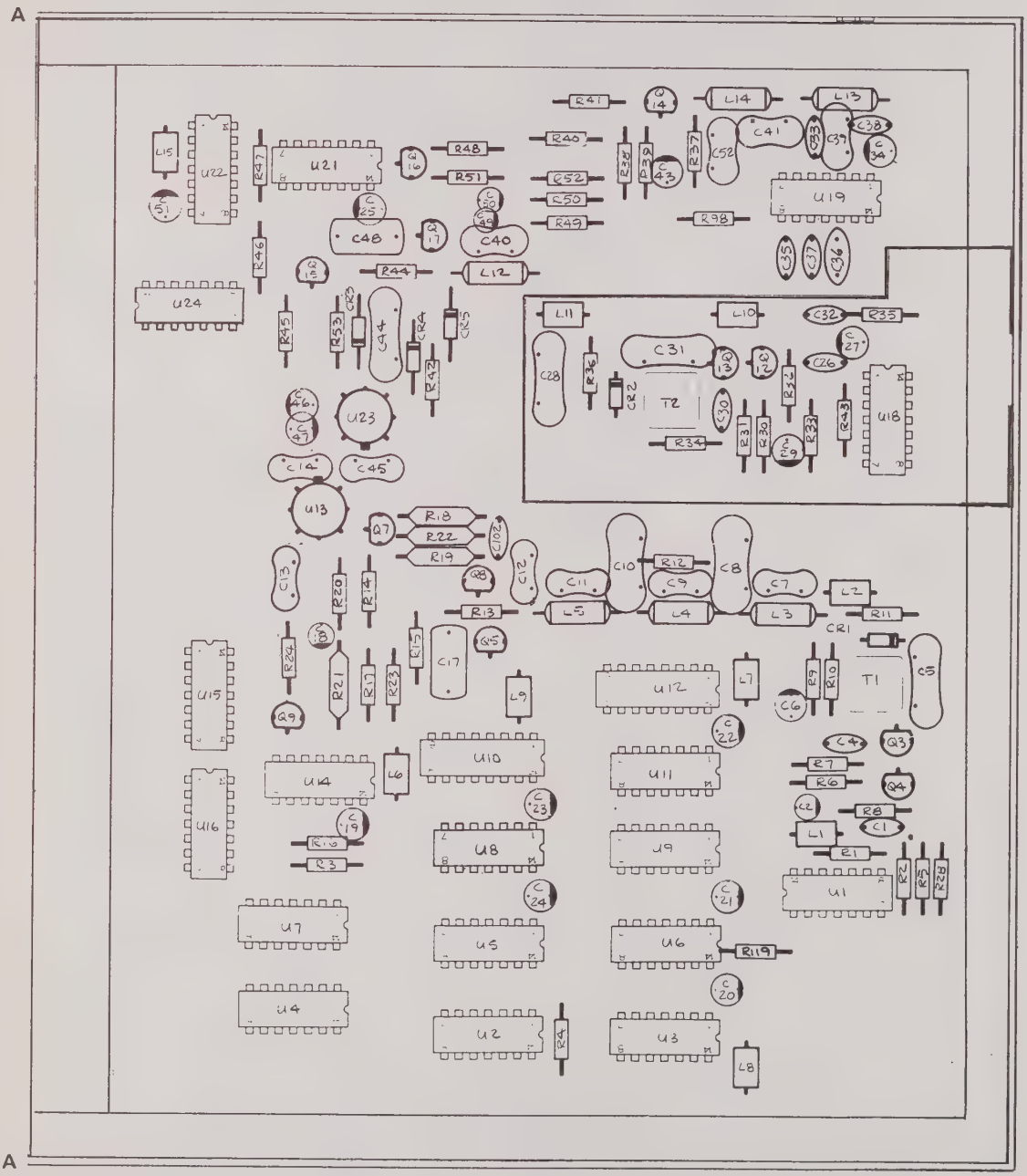

Figure 5-8. Six-Digit Generator PCB Assembly (cont)

Table 5-9. A5 Attenuator Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A5	ATTENUATOR MODULE ASSEMBLY FIGURE 5-9 (6011A-4103T)	412643	89536	412643	REF		
A5A1	ATTENUATOR PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	5		
H2	SCREW, PHP, 4-40 X 5/16	152116	73734	19023	1		
H3	WASHER, SPLIT-LOCK, #4	189710	89536	189710	1		
H4	WASHER, FLAT, #4	146225	86928	5710-18-32	1		
MP1	COVER, INNER	323204	89536	323204	1		
MP2	COVER, OUTER	426718	89536	426718	1		
MP3	NAMEPLATE	412510	89536	412510	1		

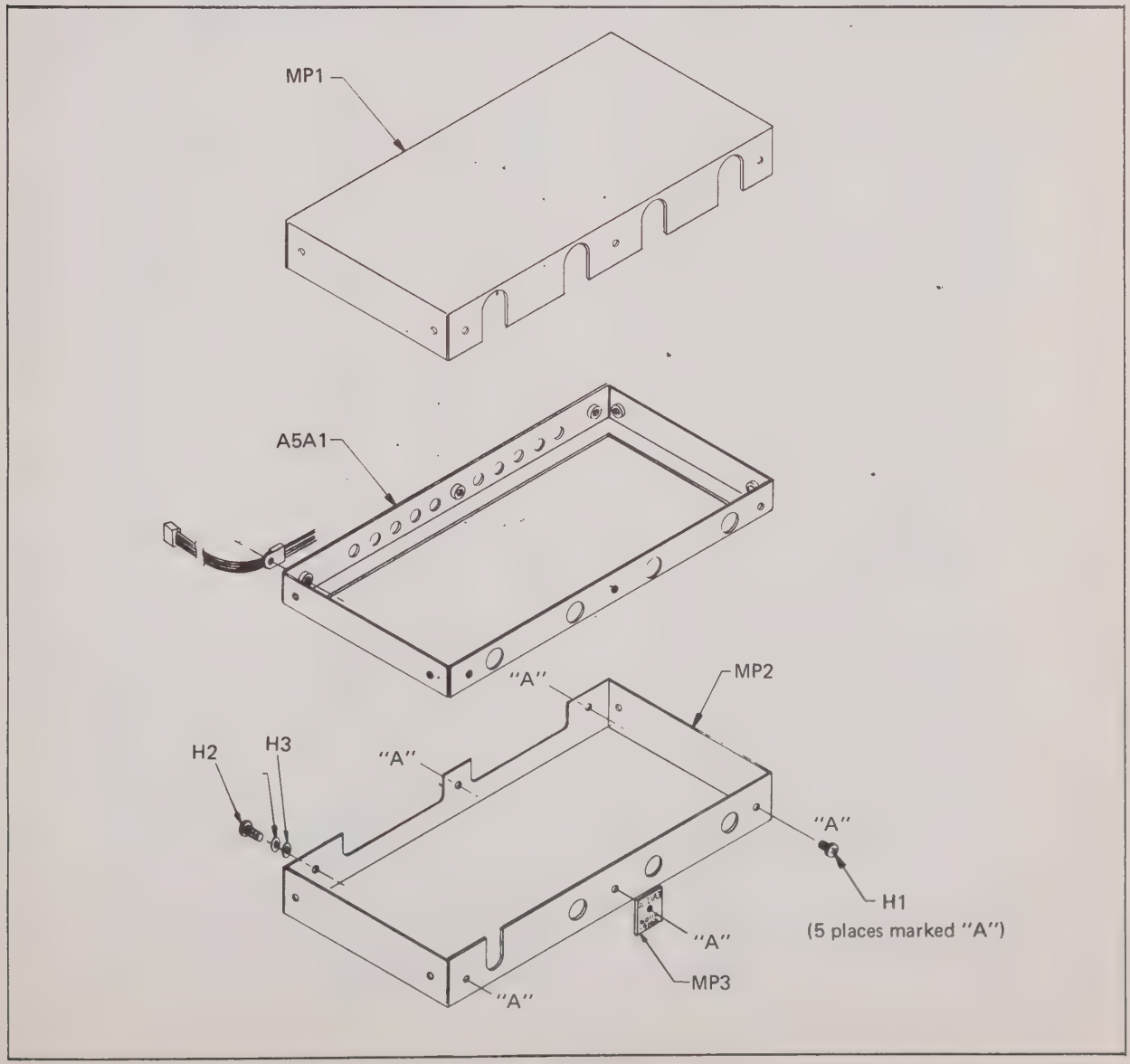

Figure 5-9. Attenuator Module Assembly

Table 5-10. A5A1 Attenuator PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A5A1	ATTENUATOR PCB ASSY	ORDER	NEXT	HIGHER ASSY			
	FIGURE 5-10 (6011A-4003)						
C1	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	4		
C2	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C3	CAP, TA, 4.7UF +/-20%, 50V	363721	56289	196D475X0050PE4	1		
C4	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C5	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020JA1	REF		
C6	CAP, FEED THRU	248286	72982	2499-003X56-252AA	6		
C7	CAP, FEED THRU	248286	72982	2499-003X56-252AA	REF		
C8	CAP, FEED THRU	248286	72982	2499-003X56-252AA	REF		
C9	CAP, FEED THRU	248286	72982	2499-003X56-252AA	REF		
C10	CAP, FEED THRU	248286	72982	2499-003X56-252AA	REF		
C11	CAP, FEED THRU	248286	72982	2499-003X56-252AA	REF		
C12	CAP, ELECT, 1000UF +50/-10%, 16V	193896	25403	ET102X016A02	1	1	
CR1	DIODE, ZENER	246611	07910	1N961B	4	1	
CR2	DIODE, HI-SPD SW	203323	07910	1N4448	3	1	
CR3	DIODE, HI-SPD SW	203323	07910	1N4448	REF		
CR4	DIODE, HI-SPD SW	203323	07910	1N4448	REF		
CR5	DIODE, ZENER	113316	07910	1N748	1	1	
CR6	DIODE, ZENER	246611	07910	1N961B	REF		
CR7	DIODE, ZENER	246611	07910	1N961B	REF		
CR8	DIODE, ZENER	246611	07910	1N961B	REF		
H1	CLAMP, CABLE	104406	91506	TA1S8	1		
H2	RIVET, 1/8 X 5/32 L	103424	12014	R3647X5-32	14		
H3	TIEWRAP	172080	06383	SST-1M	1		
J1	CABLE, RF	406595	89536	406595	1		
J3	CONNECTOR, MALE	207639	98291	51-049-0000	2		
J4	CONNECTOR, MALE	207639	98291	51-049-0000	REF		
K1	RELAY, DPDT	407536	03508	3SAV5-53-4H1	3		
K2	RELAY, DPDT	407536	03508	3SAV5-53-4H1	REF		
K3	RELAY, DPDT	407536	03508	3SAV5-53-4H1	REF		
L1	CHOKE, BEAD, 6T	320911	89536	320911	5		
L2	CHOKE, BEAD, 6T	320911	89536	320911	REF		
L3	CHOKE, BEAD, 6T	320911	89536	320911	REF		
L4	CHOKE, BEAD, 6T	320911	89536	320911	REF		
L5	CHOKE, BEAD, 6T	320911	89536	320911	REF		
MP1	MODULE FRAME	323196	89536	323196	1		
MP2	RF SHIELD	324939	89536	324939	1		
P6	CABLE, DC	419762	89536	419762	1		
R1	RES, COMP, 3.6K +/-5%, 1/4W	241620	01121	CB3625	1		
R2	RES, COMP, 1.6K +/-5%, 1/4W	266197	01121	CB1625	1		
R3	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	3		
R4	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	REF		
R5	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	REF		
R6	RES, MF, 96.247 +/-0.1%, 1/8W	416743	91637	MFF1-896R247B	1		
R7	RES, MF, 71.151 +/- 0.1%, 1/8W	416735	91637	MFF1-871R151B	1		
R8	RES, MF, 96.257 +/-0.1%, 1/4W	416727	91637	MFF1-496R247B	1		
R9	RES, COMP, 1.1K +/-5%, 1/4W	267336	01121	CB1125	1		
R10	RES, COMP, 150K +/-5%, 1/4W	18221	01121	CB1545	2		
R11	RES, COMP, 150K +/-5%, 1/4W	18221	01121	CB1545	REF		

Table 5-10 Attenuator PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R12	RES, MF, 61.111 +/-0.1%, 1/2W	408435	91637	MFF1-261R111	2		
R13	RES, MF, 247.5 +/-0.1%, 1/4W	408427	91637	MFF1-4247R5B	3		
R14	RES, MF, 61.111 +/-0.1%, 1/4W	408419	91637	MFF1-461R111B	4		
R15	RES, COMP, 1.3K +/-5%, 1/4W	234252	01121	CB1325	1		
R16	RES, MF, 61.111 +/-0.1%, 1/2W	408435	91637	MFF1-261R111	REF		
R17	RES, MF, 247.5 +/-0.1%, 1/4W	408427	91637	MFF1-4247R5B	REF		
R18	RES, MF, 61.111 +/-0.1%, 1/4W	408419	91637	MFF1-461R111B	REF		
R19	RES, MF, 61.111 +/-0.1%, 1/4W	408419	91637	MFF1-461R111B	REF		
R20	RES, MF, 247.5 +/-0.1%, 1/4W	408427	91637	MFF1-4247R5B	REF		
R21	RES, MF, 61.111 +/-0.1%, 1/4W	408419	91637	MFF1-461R111B	REF		
U1	IC, LIN, DUAL, INLINE	386920	18324	NE529A	1	1	
U2	IC, NAND GATE, QUAD, 2-INPUT	363580	01295	SN74S00N	1	1	
U3	IC, TTL, HEX INVERTER	407593	01295	SN7406N	1	1	
XK1	TRANSIPAD	296319	32559	TO-8-06	12		
XK2	TRANSIPAD	296319	32559	TO-8-06	REF		
XK3	TRANSIPAD	296319	32559	TO-8-06	REF		
XK4	TRANSIPAD	296319	32559	TO-8-06	REF		
XK5	TRANSIPAD	296319	32559	TO-8-06	REF		
XK6	TRANSIPAD	296319	32559	TO-8-06	REF		
XK7	TRANSIPAD	296319	32559	TO-8-06	REF		
XK8	TRANSIPAD	296319	32559	TO-8-06	REF		
XK9	TRANSIPAD	296319	32559	TO-8-06	REF		
XK10	TRANSIPAD	296319	32559	TO-8-06	REF		
XK11	TRANSIPAD	296319	32559	TO-8-06	REF		
XK12	TRANSIPAD	296319	32559	TO-8-06	REF		

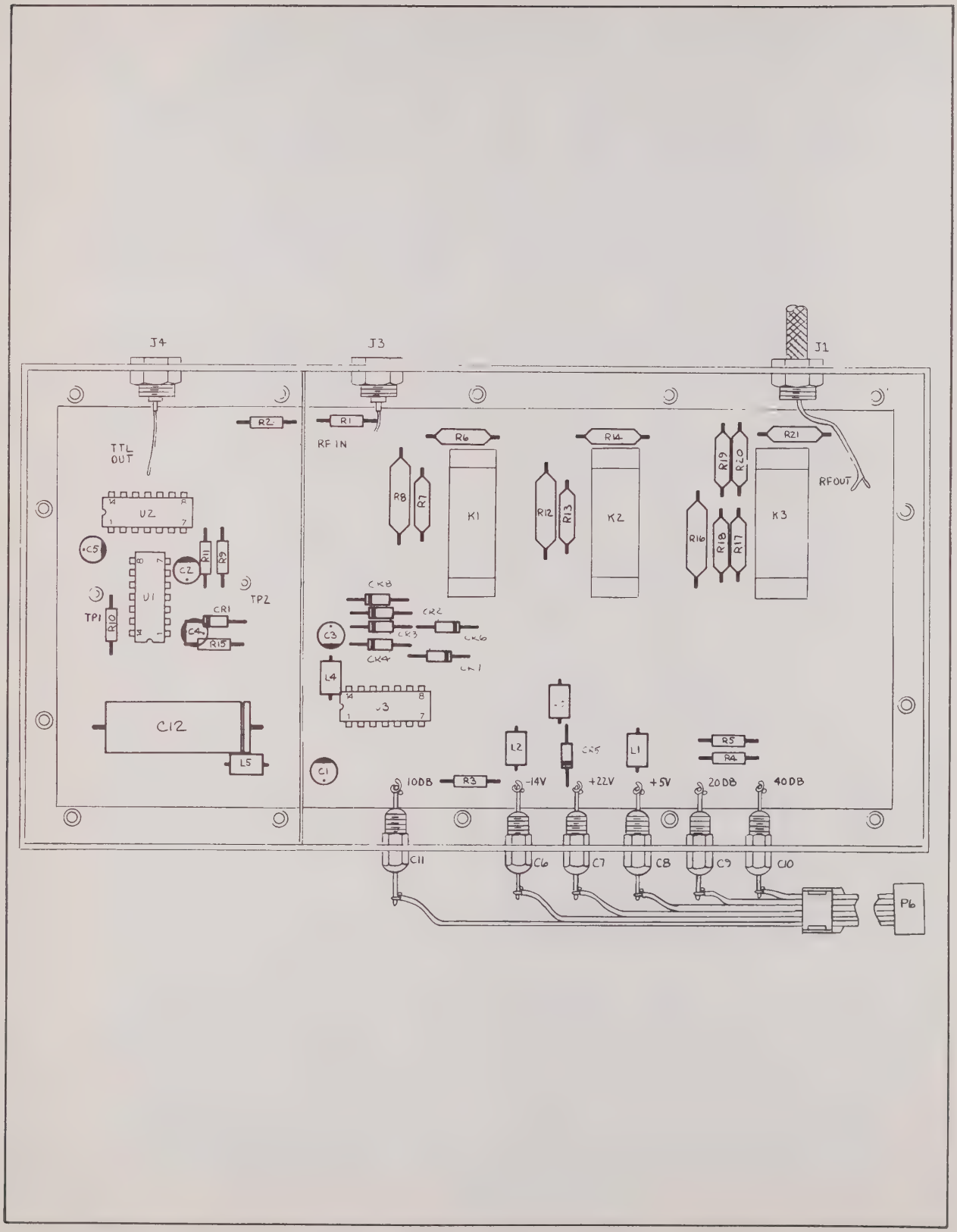

Figure 5-10. A5A1 Attenuator PCB Assembly

Table 5-11. A6 Amplitude D/A Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A6	AMPLITUDE D/A MODULE ASSEMBLY FIGURE 5-11 (6011A-4109T)	412650	89536	412650	REF		
A6A1	AMPLITUDE D/A PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	5		
H2	SCREW, PHP, 4-40 X 5/16	152116	73734	19023	1		
H3	WASHER, SPLIT-LOCK, #4	185710	89536	185710	1		
H4	WASHER, FLAT, #4	146225	86928	5710-18-32	1		
MP1	COVER, INNER	323204	89536	323204	1		
MP2	COVER, OUTER	323212	89536	323212	1		
MP3	NAMEPLATE	412528	89536	412528	1		

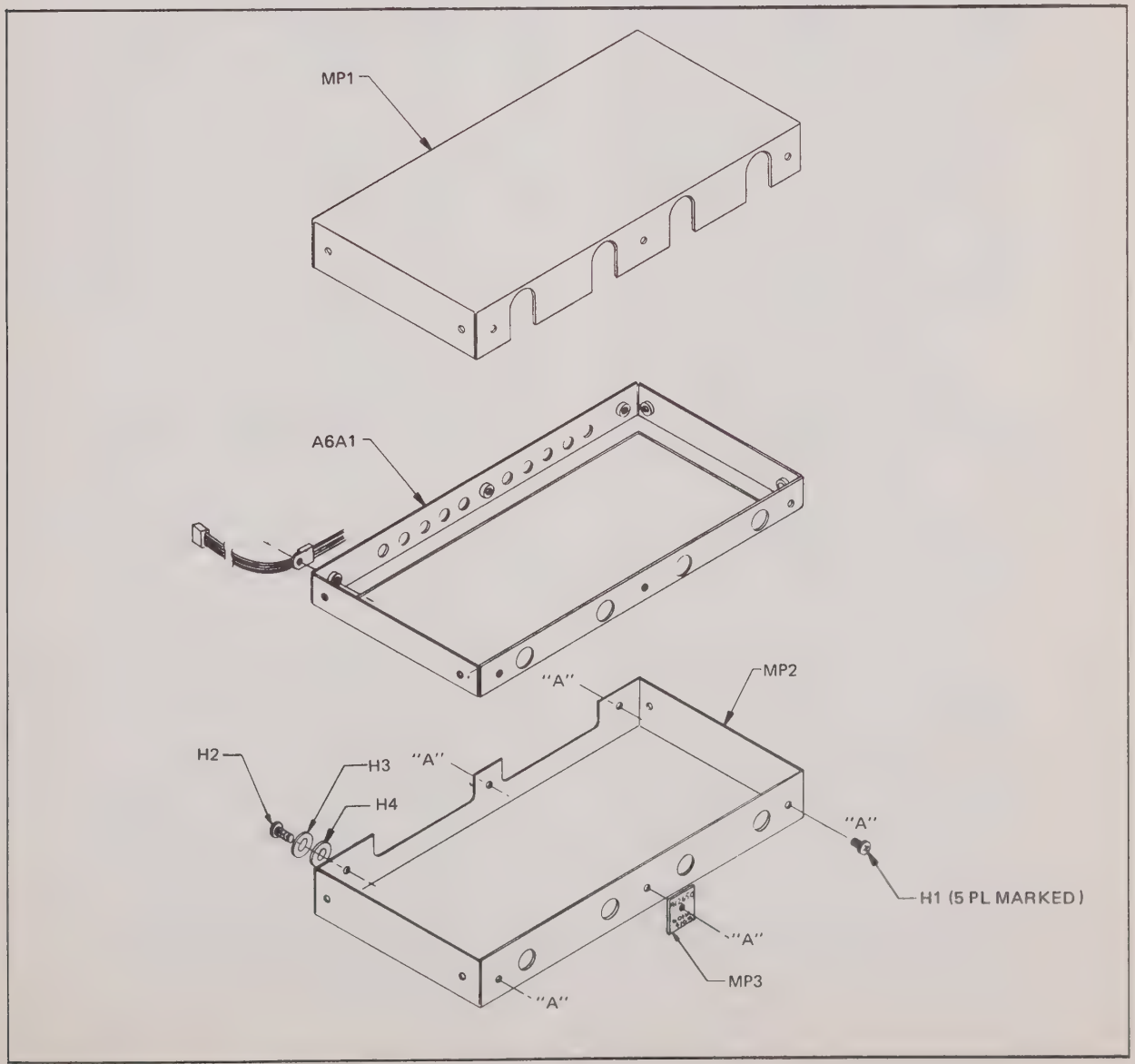

Figure 5-11. A6 Amplitude D/A Module Assembly

Table 5-12. A6A1 Amplitude D/A PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A6A1	⊗AMPLITUDE D/A PCB ASSY FIGURE 5-12 (6011A-4009)	ORDER	NEXT	HIGHER ASSY			
C1	CAP, FXD, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	4		
C2	CAP, FXD, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C3	CAP, FXD, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C5	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	10		
C6	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C7	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C8	CAP, FXD, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C9	CAP, FXD, MICA, 330PF +/-5%, 500V	148445	71236	DM15F331J	2		
C10	CAP, FXD, CER, 0.005UF +/-20%, 100V	175232	56289	C023B101E502M	1		
C11	CAP, POLYCBN, 0.033UF +/-10%, 100V	288894	84411	X463UW03391W	1		
C12	CAP, FXD, MICA, 30PF +/-5%, 500V	340570	71236	DM15E300J	2		
C13	CAP, POLYCBN, 0.15UF +/-5%, 50V	343616	84411	X463UW1550W	1		
C14	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C15	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C16	CAP, FXD, MICA, 220PF +/-5%, 500V	170423	71236	DM15F221J	1		
C17	CAP, FXD, MICA, 330PF +/-5%, 500V	148445	71236	DM15F331J	REF		
C18	CAP, FXD, MICA, 843PF +/-1%, 500V	182907	71236	DM20F843F	1		
C19	CAP, FXD, MICA, 1500PF +/-5%, 500V	148361	71236	DM19F152J	1		
C20	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C21	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C22	CAP, FXD, MICA, 12PF +/-5%, 500V	175224	71236	DM15C120J	1		
C23	CAP, FXD, MICA, 30PF +/-5%, 500V	340570	71236	DM15E300J	REF		
C24	CAP, TA, 22UF +/-20%, 25V	357780	56289	196D226X0025PE4	1		
C25	CAP, CER, 0.22UF +/-20%, 50V	309849	71590	CW30C224K	1		
C26	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C27	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C28	CAP, TA, 10UF +/-20%, 20V	330662	56289	196D106X0020KA1	REF		
C29	CAP, FXD THRU, 2500PF GMV	248286	32897	2499-003X5U-252AA	3		
C30	CAP, FXD THRU, 2500PF GMV	248286	32897	2499-003X5U-252AA	REF		
C31	CAP, FXD THRU, 2500PF GMV	248286	32897	2499-003X5U-252AA	REF		
CR5	DIODE, ZENER, 5.1V	159798	07910	1N751A	1	1	
CR6	DIODE, HI-SPEED SW	203323	07910	1N4448	1	1	
H1	PLUG, BOTTOM	170118	83330	625	1		
H2	GROMMET, 3/16	102772	83330	2185	4		
H3	RIVET	103424	12014	R3647X5-32	14		
H4	CABLE CLAMP	104406	91506	TA1S8	1		
H5	TRANSIPAD	225722	13103	7717-145-DAP	1		
H6	TIEWRAP	172080	06383	SST-1M	1		
J1	CONN, SUB-MINI, MOLE	207639	98291	51-049-0000	3		
J2	CONN, SUB-MINI, MOLE	207639	98291	51-049-0000	REF		
J4	CONN, SUB-MINI, MOLE	207639	98291	51-049-0000	REF		
L1	INDUCTOR, BEAD, 6T	320911	89536	320911	3		
L2	INDUCTOR, BEAD, 6T	320911	89536	320911	REF		
L3	INDUCTOR, BEAD, 6T	320911	89536	320911	REF		
L4	INDUCTOR, 68,000UH	414235	24759	MR68,000	1		
L5	INDUCTOR, 100,000UH	363226	24759	MR 100,000	1		
MP1	MODULE, INNER FRAME	323196	89536	323196	1		
P12	CABLE, DC	419754	89536	419754	1		

Table 5-12. A6A1 Amplitude D/A PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
P13	CABLE, CONTROL	417535	08621	6331-009-X	1		
Q1	REF AMP SET (Q1, R17, R19)	419804	89536	419804	1	1	
R1	RES, MF, 100K +/-1%, 1/8W	248807	91637	MFF1-81003F	1		
R2	RES, MF, 200K +/-1%, 1/8W	261701	91637	MFF1-82003F	1		
R3	RES, MF, 402K +/-1%, 1/8W	217984	91637	MFF1-84023F	1		
R4	RES, MF, 806K +/-1%, 1/8W	217976	91637	MFF1-88063F	1		
R5	RES, COMP, 1.5K +/-5%, 1/4W	148031	01121	CB1525	1		
R9	RES, COMP, 620 +/-5%, 1/4W	221903	01121	CB6215	1		
R10	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	MFF1-84992	2		
R11	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	MFF1-84992	REF		
R12	RES, MF, 10.0K +/-1%, 1/8W	168260	91637	MFF1-81002F	1		
R13	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	3		
R14	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R15	RES, COMP, 6.2K +/-5%, 1/4W	221911	01121	CB6225	REF		
R16	RES, MF, 4.75K +/-1%, 1/8W	260679	91637	MFF1-84751F	2		
R17	REF AMP SET (Q1, R17, R19)	419804	89536	419804	REF		
R18	RES, MF, 3.74K +/-1%, 1/8W	272096	91637	MFF1-83741F	1		
R19	REF AMP SET (Q1, R17, R19)	419804	89536	419804	REF		
R20	RES, MF, 14K +/-0.1%, 1/8W	344424	91637	MFF1-81402B	2		
R21	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	1		
R22	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	7		
R23	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R24	RES, MF, 9.09K +/-1%, 1/8W	221663	91637	MFF1-89091F	1		
R26	RES, MF, 191K +/-1%, 1/8W	375923	91637	MFF1-81913F	2		
R28	RES, VAR, 50K +/-10%, 1/2W	335778	71450	360T503A	1	1	
R29	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	2		
R31	RES, MF, 10K +/-0.1%, 1/8W	343459	01121	MFF1-81002B	2		
R32	RES, MF, 191K +/-1%, 1/8W	375923	91637	MFF1-81913F	REF		
R33	RES, MF, 4.75K +/-1%, 1/8W	260679	91637	MFF1-84751F	REF		
R34	RES, MF, 14K +/-0.1%, 1/8W	344424	91637	MFF1-81402B	REF		
R35	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R36	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R37	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	2		
R38	RES, COMP, 100K +/-5%, 1/4W	148189	01121	CB1045	1		
R39	RES, COMP, 9.1K +/-5%, 1/4W	193318	01121	CB9125	1		
R40	RES, VAR, 2K +/-10%, 1/2W	309666	71450	360T-202K	1	1	
R41	RES, MF, 10.08K +/-0.1%, 1/8W	346908	89536	346908	1		
R42	RES, MF, 1M +/-0.5%, 1/8W	198234	91637	MFF1-81004D	1		
R43	RES, VAR, 20K +/-10%, 1/2W	335760	71450	360T203A	1	1	
R44	RES, COMP, 10M +/-5%, 1/4W	194944	01121	CB1065	REF		
R45	RES, MF, 9.53K +/-1%, 1/8W	288563	91637	MFF1-89531F	1		
R46	RES, VAR, 100 +/-10%, 1/2W	275735	71450	630T101A	1	1	
R47	RES, COMP, 51K +/-5%, 1/4W	193334	01121	CB5135	1		
R48	RES, MF, 10.5K +/-1%, 1/8W	234096	91637	MFF1-81002F	1		
R49	RES, MF, 28K +/-1%, 1/8W	291385	91637	MFF1-82802F	1		
R50	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R51	RES, COMP, 2.2M +/-5%, 1/4W	198390	01121	CB2255	1		
R52	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R53	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		
R54	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	REF		

Table 5-12. A6A1 Amplitude D/A PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U1	IC, DIG, TTL, QUAD D F/F	407601	12040	DM86L13	5	1	
U2	IC, DIG, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U3	IC, DIG, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U4	IC, DIG, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U5	IC, DIG, TTL, QUAD D F/F	407601	12040	DM86L13	REF		
U6	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	6	2	
U7	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	REF		
U8	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	REF		
U9	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	REF		
U10	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	REF		
U11	IC, DIG, TTL, DECADE CNTR	414227	01295	S74LS162N	REF		
U12	IC, TTL, HEX INVERTER	292979	01295	SN7404N	1	1	
U13	IC, TTL, HEX INVERTER, BUF/DRVR	288605	01295	SN7416N	2	1	
U14	RES, NETWORK, 1.5K	424176	89536	424176	1		
U15	⊗IC, C-MOS, QUAD BILATERAL SW	408062	18725	CD4066AE	1	1	
U16	IC, TTL, HEX INVERTER, BUF/DRVR	288605	01295	SN7416N	REF		
U17	IC, OP AMP, DUAL GEN PURPOSE, INT COMP	414284	12040	LM1458N	2	1	
U18	⊗IC, C-MOS, QUAD BILATERAL SW	363838	18725	CD4016AE	1	1	
U19	IC, OP AMP, LOW BIAS CURRENT	413732	12040	LM308N	1	1	
U20	IC, OP AMP, DUAL GEN PURPOSE, INT COMP	414284	12040	LM1458N	REF		
U21	IC, OP AMP, J-FET, INPUT	310037	12040	LH0042C	1	1	
U22	IC, OP AMP, INT COMP	413740	12040	LM307N	1	1	
U23	IC,TTL,MSI, RETRIGGERABLE MONOSTABLE MV	293134	07263	U6A960159X	1	1	
U24	IC, LINEAR, SPC TIMER	402610	12040	NE555V	1	1	
U25	IC, DUAL D F/F	310227	01295	SN7474N	1	1	
U26	RES, NETWORK, 1.5K	414011	89536	414011	1		
XU15	SOCKET, IC	370304	01295	C931402	2		
XU18	SOCKET, IC	370304	01295	C931402	REF		

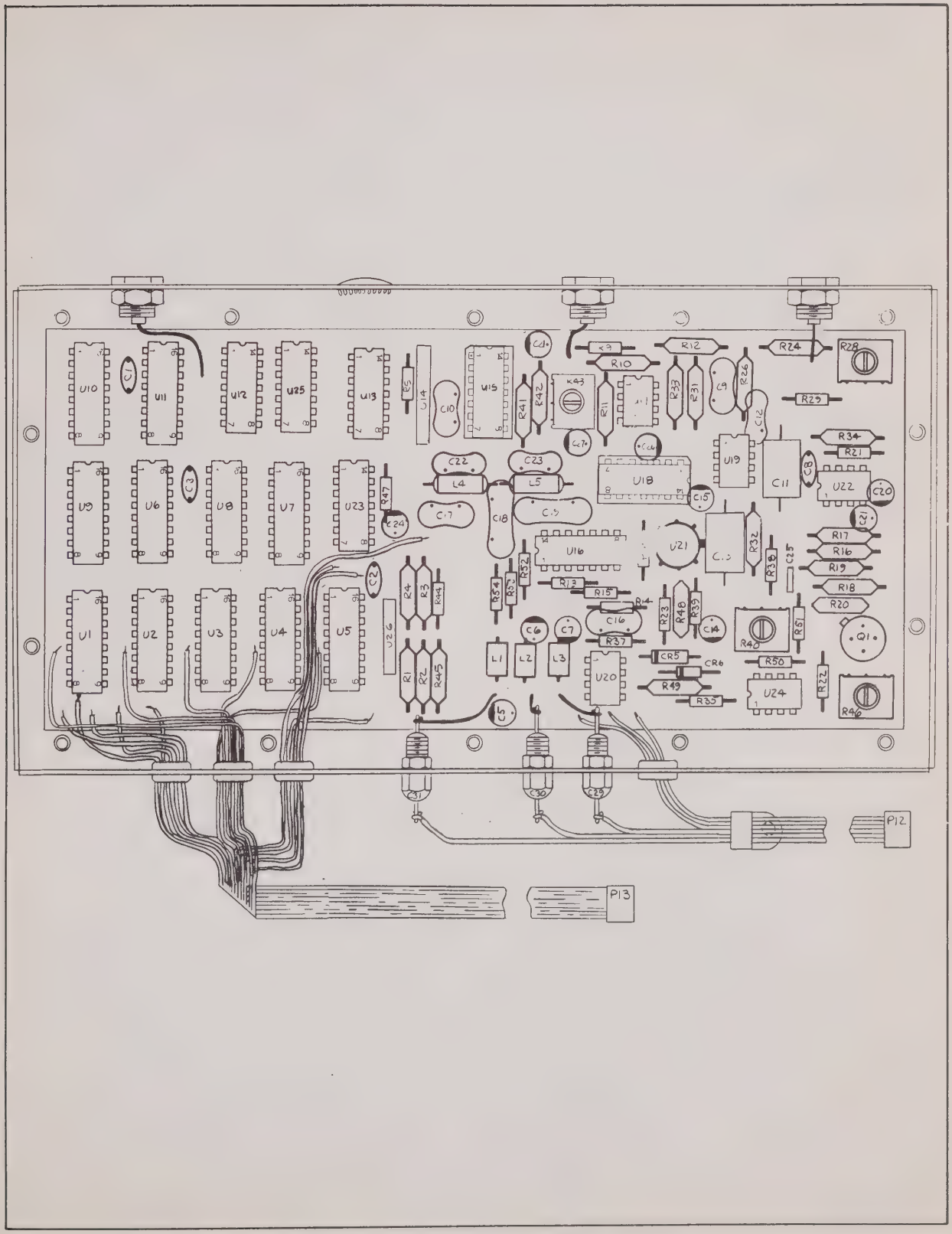

Figure 5-12. A6A1 Amplitude D/A PCB Assembly

Section 6
Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains the information necessary to install, operate and maintain the options and /or accessories which are available for use with the Model 6011A Synthesized Signal Generator. The information provided is divided into subsections, with each option comprising a subsection and the accessories as a whole, comprising a subsection. The location of a particular subsection is facilitated by the use of unique page and paragraph numbering which corresponds to the option or accessories in question. For example, a 600-x series identifies the Accessories subsection and a 605-x series identifies the subsection for the -05 Option (where x is sequential page or paragraph numbers). The available options are identified in the following table of contents. Replaceable parts are listed in table form with each option. Also, component location diagrams are provided in figure form with each option.

TABLE OF CONTENTS

OPTION/ MODEL NO.	TITLE	PAGE
ACCESSORIES		
M05-203-601	Left or Right Offset Rack Mounting Kit	600-1
M05-203-602	Center Rack Mounting Kit	600-1
M05-200-603	Dual Side-by-Side Rack Mounting Kit	600-1
M00-260-610	18″ Chassis Slides	600-1
M00-203-631	Left or Right Offset Rack Mounting Kit including 18″ Chassis Slides	600-1
OPTIONS		
-01	High Performance TCXO	601-1
-02	Phase Lock Input	602-1
-03	Frequency Modulation	603-1
-04	Rear Panel Output	604-1
-05	IEC-ASCII Remote Programming Interface	605-1
-06	RS-232-C Remote Programming Interface	606-1
-07	50-400 Hz Line Power	607-1
-08	100V, 50-60 Hz Line Power	608-1
-09	20-31 MHz Tracking Output	609-1
-10	75Ω Output Impedance	610-1

Accessories

600-1. INTRODUCTION

600-2. This material describes the accessory kits and indicates their basic use. For more detailed information, refer to the instruction sheet included in each kit. When ordering a kit, include the model number and name.

600-3. 6010A/6011A RACK MOUNTING KITS/SLIDES

600-4. These half rack width signal generators may be mounted in left offset, right offset, center mount, or dual configurations with or without slide.

1. M05-203-601

   Left or right offset rack mounting kit. Use of slides not possible, generator should be supported at side or rear.

2. M05-203-602

   Centered rack mounting kit for one instrument. Use of slides not possible; generator should be supported at rear.

3. M05-200-603

   Dual side-by-side rack mounting kit. Instruments must be supported at sides, rear or with slides.

4. M00-260-610

   18″ chassis slides for use with dual side-by-side rack mounting kit.

5. M00-203-631

   Left or right offset rack mounting kit including 18″ chassis slides. Mounts one generator.

600-5. 6010A/6011A SERVICE KIT

600-6. The 6010A/6011A Service Kit, Model number 6010A-7001K, consists of a set of extender cables, an adapter board, and tuning tools to facilitate maintenance. With the kit, the instrument may be operated normally with the modules partially or completely removed from the instrument. The kit includes a Tee adapter block that enables inter-module signal to be monitored without interrupting the signal path.

Option -01
High Performance TCXO

601-1. INTRODUCTION

601-2. This option replaces the standard Model 6011A TCXO with a high performance TCXO to enhance instrument stability. The high performance TCXO is a non-repairable, factory installed assembly. The -01 Option must be selected at the time of purchase.

601-3. SPECIFICATIONS

601-4. **Frequency Accuracy:** ± 1.5 parts in 10^6 for one year over a temperature range of 0°C to +50°C (32°F to 122°F).

Aging Rate: <1 part in 10^8 per 24 hours at constant temperature, or 1 part in 10^6 per year.

Temperature Dependence: ± 5 parts in 10^7 from 0°C to +50°C (32°F to 122°F).

601-5. CALIBRATION

601-6. Calibration of the Model 6011A equipped with the -01 Option is the same as that of the standard instrument. See Section 4 for the calibration procedures.

Option -02
Phase Lock Input

602-1. INTRODUCTION

602-2. The Phase Lock Input Option allows the 10 MHz basic reference frequency of the Model 6011A to be synched to an external reference of 10 MHz, 5 MHz, 2.5 MHz, 2 MHz, or 1 MHz. The level range of the input is 100 mV to 5V rms into 50Ω. The internal 10 MHz TCXO will phase lock to the external reference provided the external reference is within 5 ppm of the 10 MHz internal oscillator frequency. When phase locked, the Model 6011A output frequency, accuracy, and stability are related to the external reference applied to the Phase Lock Input -02 Option. This option is factory installed. This option and the Frequency Modulation -03 Option are mutually exclusive.

602-3. THEORY OF OPERATION

602-4. The Phase Lock Input option is illustrated by Figure 602-1, Phase Lock Input Option Block Diagram. The schematic diagram provides details of the circuit.

602-5. An external reference applied to the EXT REF connector on the rear panel of the Model 6011A is routed to J1 on the Phase Lock Input Module. The signal at J1 is applied to the input of a TTL converter. The TTL compatible signal from the TTL converter is input to a signal detector and the phase detector. The phase detector compares the TTL input with the output of the TC/VCXO. A difference in phase causes the amplifier to output a control voltage to the voltage controlled oscillator. The signal detector circuit will, when an external reference is applied to J1, close the switch to connect the amplifier to the voltage control input of the oscillator. The control voltage from the phase detector locks the output of the TC/VCXO to the phase of the external reference frequency. This locked 10 MHz signal is routed to the Input/Output Module where it replaces the standard TCXO output for instrument timing.

602-6. TROUBLESHOOTING

602-7. The material in this section provides fault isolation guidelines. The operational check procedure is followed by Table 602-1, Fault Isolation Guide, which covers the two most likely faults - no output from the module and failure to phase lock.

602-8. OPERATION CHECK

602-9. Use this procedure to check the operation of the Phase Lock Input Module.

1. Unplug the Model 6011A power cord and remove the top dust cover.

2. Swing the Six-Digit Generator Module out (see Section 4) to gain access to the Phase Lock Input Module.

3. Remove the four mounting screws from the sides of the Phase Lock Input Module.

4. Lift the Phase Lock Input Module out of the instrument and place it on the top of the instrument chassis.

5. Place insulating material between the instrument chassis and the Phase Lock Input Module.

6. Remove the top cover from the Phase Lock Input Module.

7. Plug the Model 6011A power cord into line power.

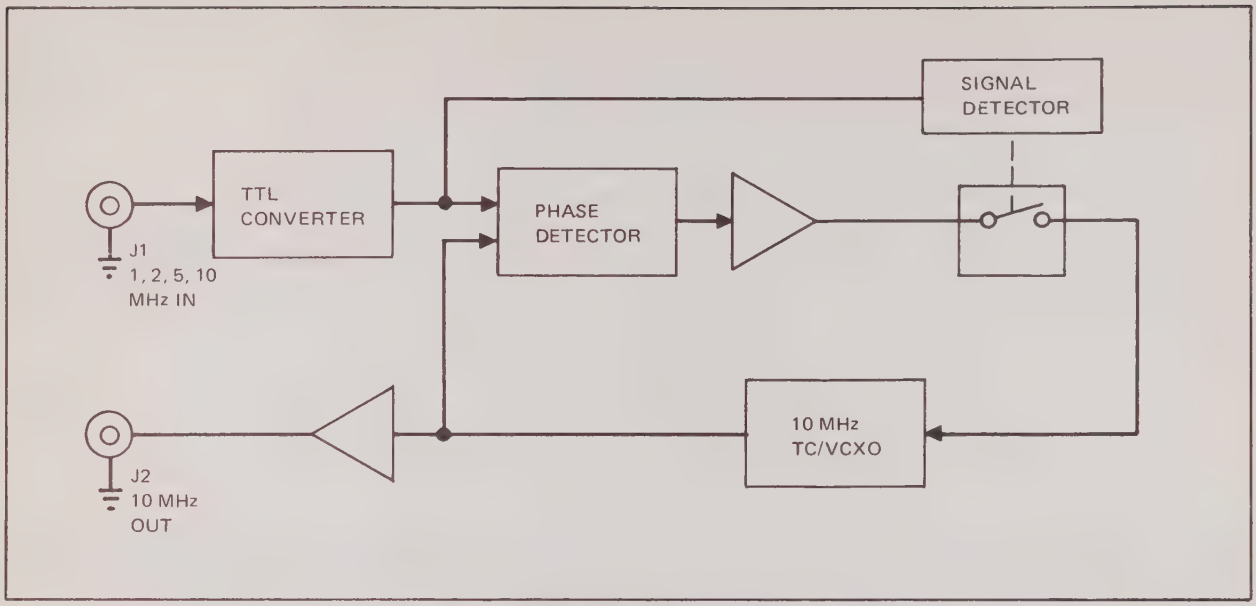

Figure 602-1. Phase Lock Input Option Block Diagram

8. Press the POWER control.

9. Connect a frequency counter to the signal lead connecting the pcb to J2.

10. Verify that the frequency is 10 MHz ±2 Hz.

11. Adjust Y1, Cal. Adjust, if required.

12. Connect a DVM to TP2.

13. Verify that the DVM indication is 0 to 10 mV.

14. Connect a signal generator to the EXT REF input on the Model 6011A rear panel.

15. Set the external signal generator so that the external reference is 10 MHz at +13 dBm.

16. Vary the external reference frequency by ±30 Hz.

17. Verify a corresponding change in frequency indicated on the counter.

18. To reassemble the instrument, logically reverse this procedure.

602-10. -02 Option, LIST OF REPLACEABLE PARTS

602-11. For column entry explanations, parts ordering information, and basic instrument configuration, refer to Section 5 of this manual. A list of replaceable parts for the -02 Option is provided in Tables 602-2 and 602-3. These tables are illustrated in Figures 602-2 and 602-3, respectively.

Table 602-1. Fault Isolation Guide

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Is there a signal at J2 (U6, pin 11)?	x		8
			x	2
2	Is there a 10 MHz signal at U6, pin 1?	x		4
			x	3
3	Replace U6.			
4	Is Y1, pin 3 ±14?	x		5
			x	6
5	Replace U1.			
6	Are the following voltages correct? P7-1 +14V P7-3 −14V P7-4 +5V	x		15
			x	7
7	Troubleshoot and repair power supply and transmission of the erroneous voltage.			1
8	Does the 10 MHz TC/VCXO output phase lock to the input?	x		16
			x	9
9	Are the following voltages at TP2 correct? 0 ±0.01V for 10 MHz ±1 Hz external reference frequency −2.4V to −4V for 10 MHz +30 Hz external reference frequency +2.4V to +4V for 10 MHz −30 Hz external reference frequency	x		5
			x	10
10	Does the voltage at TP2 remain at zero when the external reference grequency is changed?	x		11
			x	14
11	Are the voltages at the junction of R18 and R19 correct?	x		12
			x	13
12	Troubleshoot U4 and U5.			1
13	Troubleshoot U3, Q3, and Q4.			1
14	Troubleshoot U2, U3, Q3, and Q4.			1
15	Troubleshoot and repair as necessary.			1
16	The fault is not in the Phase Lock Input Module.			

Table 602-2. Phase Lock Input Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A7	PHASE LOCK INPUT MODULE ASSY FIGURE 602-2 (6010A-4106)	391037	89536	391037	REF		
A7A1	PHASE LOCK INPUT PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	SCREW, PHP, 4-40 X 1/4	129890	89536	129890	5		
H2	SCREW, PHP, 4-40 X 5/16	152116	89536	152116	1		
H3	WASHER, SPLIT, #4	185710	89536	185710	1		
H4	WASHER, FLAT, #4	146225	89536	146225	1		
MP1	COVER, INNER	323204	89536	323204	1		
MP2	COVER, OUTER	323212	89536	323212	1		
MP3	NAMEPLATE	405282	89536	405282	1		

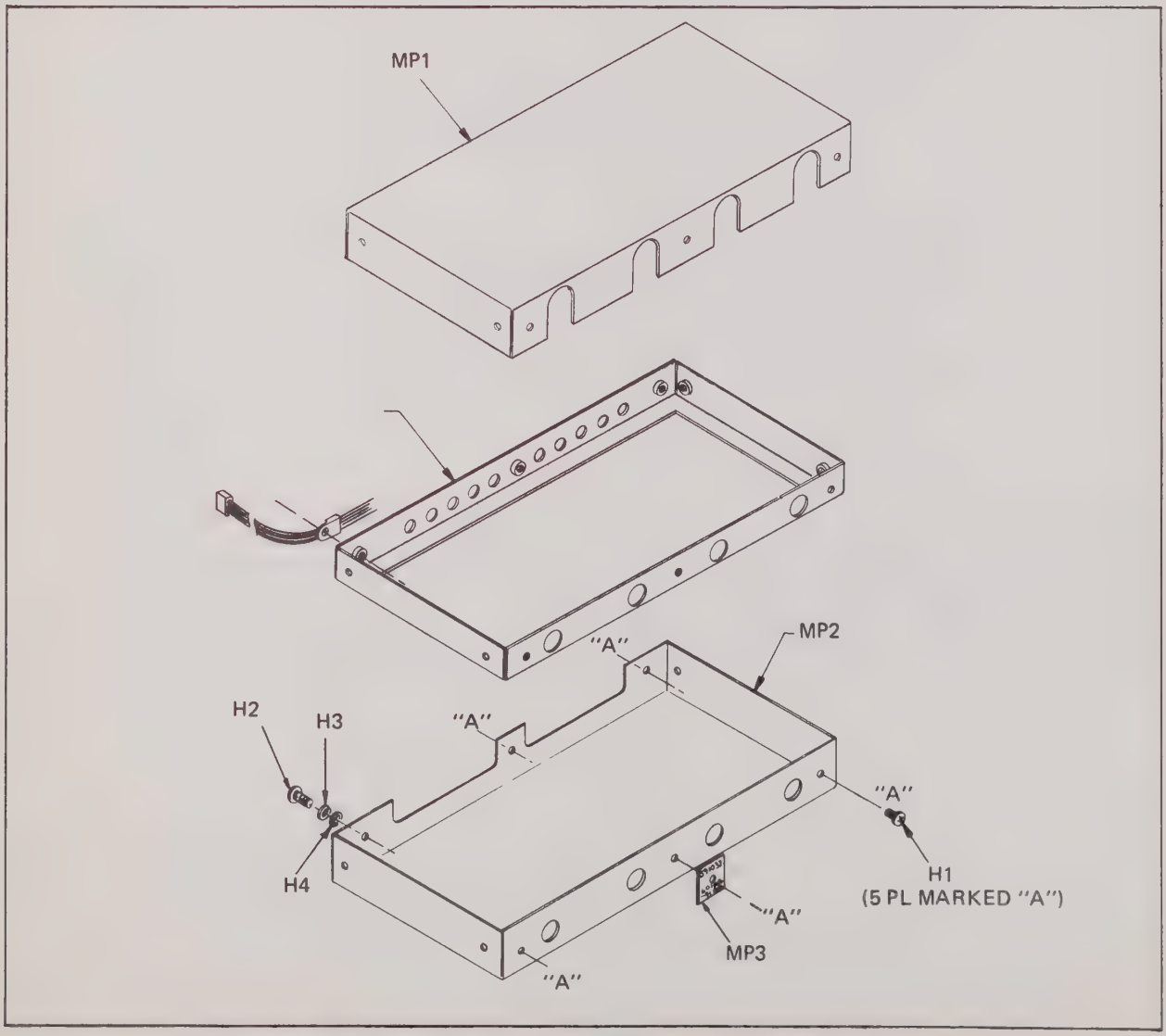

Figure 602-2. Phase Lock Input Module Component Location Diagram

Table 602-3. Phase Lock Input PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A7A1	PHASE LOCK INPUT PCB ASSY FIGURE 602-3 (6010A-4006)	ORDER	NEXT	HIGHER ASSY			
C1	CAP, CER, 0.05UF +80/-20%, 25V	148924	72982	5855-000-Y500-503Z	5		
C2	CAP, CER, 0.05UF +80/-20%, 25V	148924	72982	5855-000-Y500-503Z	REF		
C3	CAP, CER, 0.05UF +80/-20%, 25V	148924	72982	5855-000-Y500-503Z	REF		
C4	CAP, FEED THRU, 2500UF +/-GMV, 500V	248286	72982	2499-003X5U-252AA	3		
C5	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	7		
C6	CAP, FEED THRU, 2500PF +/-GNV, 500V	248286	72982	2499-003X5U-252AA	REF		
C7	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C8	CAP, FEED THRU, 2500PF +/-GNV, 500V	248286	72982	2499-003X5U-252AA	REF		
C9	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C10	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C11	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C12	CAP, CER, 0.05UF +80/-20%, 25V	148924	72982	5855-000-Y500-503Z	REF		
C13	CAP, PLSTC, 0.0047UF +/-20%, 200V	106054	56289	192P47202	2		
C14	CAP, MICA, 33PF +/-5%, 500V	160317	72136	DM15E3305	1		
C15	CAP, PLSTC, 0.0047UF +/-20%, 200V	106054	56289	192P47202	REF		
C16	CAP, CER, 0.05UF +80/-20%, 25V	148924	72982	5855-000-Y500-503Z	REF		
C17	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	2		
C19	CAP, CER, 0.01UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C20	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C21	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
C29	CAP, TA, 10UF, +/-20%, 20V	330662	56289	196D106X0025KA1	REF		
CR1	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	6	2	
CR2	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	REF		
CR3	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	REF		
CR4	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	REF		
CR5	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	REF		
CR6	DIODE, SI, HI-SPEED SW	203323	07910	1N4148	REF		
H1	BUTTON, SNAP	170118	83330	652	2		
H2	BUTTON, SNAP	170118	83330	652	REF		
H3	RIVET	103424	12014	R3647X5-32	14		
H4	CLAMP, CABLE	104406	89536	104406	1		
J1	CONN	207639	93291	51-049-0000	2		
J2	CONN	207639	93291	51-049-0000	REF		
L1	INDUCTOR, RF	320911	89536	320911	5		
L2	INDUCTOR, RF	320911	89536	320911	REF		
L3	INDUCTOR, RF	320911	89536	320911	REF		
L4	INDUCTOR, RF	320911	89536	320911	REF		
L5	INDUCTOR, RF	320911	89536	320911	REF		
MP1	CONN, AMP	386144	00799	3-332070	6		
MP2	CONN, AMP	386144	00799	3-332070	REF		
MP3	CONN, AMP	386144	00799	3-332070	REF		
MP4	CONN, AMP	386144	00799	3-332070	REF		
MP5	CONN, AMP	386144	00799	3-332070	REF		
MP6	CONN, AMP	386144	00799	3-332070	REF		
MP7	FRAME, MODULE, INNER	323196	89536	323196	1		
Q1	XSTR, SI, PNP	229898	04713	MPS6522	3	1	
Q2	XSTR, SI, NPN	218081	04713	MPS6520	1		
Q3	XSTR, SI, PNP	229898	04713	MPS6522	REF		

Table 602-3. Phase Lock Input PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q4	XSTR, SI, PNP	229898	04713	MPS6522	REF		
R1	RES, COMP, 51 +/-5%, 1/4W	221879	01121	CB5105	1		
R2	RES, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	2		
R3	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	3		
R4	RES, COMP, 47 +/-5%, 1/4W	147982	01121	CB4705	3		
R5	RES, COMP, 4.7K +/-5%, 1/4W	148072	01121	CB4725	2		
R6	RES, COMP, 4.7K +/-5%, 1/4W	148072	01121	CB4725	REF		
R7	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	2		
R8	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	3		
R9	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	REF		
R10	RES, COMP, 47 +/-5%, 1/4W	147982	01121	CB4705	REF		
R11	RES, COMP, 47 +/-5%, 1/4W	147982	01121	CB4705	REF		
R12	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R13	RES, COMP, 270 +/-5%, 1/4W	160804	01121	CB2715	REF		
R14	RES, COMP, 33 +/-5%, 1/4W	175034	01121	CB3305	2		
R15	RES, COMP, 6.8K +/-5%, 1/4W	148098	01121	CB6825	1		
R16	RES, COMP, 33 +/-5%, 1/4W	175034	01121	CB3305	REF		
R17	RES, MF, 225K +/-1%, 1/8W	221630	91637	CMF552253F	1		
R18	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	REF		
R19	RES, COMP, 1.8K +/-5%, 1/4W	175042	01121	CB1825	1		
R20	RES, COMP, 2.2K +/-5%, 1/4W	148049	01121	CB2225	1		
R21	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	REF		
R22	RES, COMP, 47K +/-5%, 1/4W	148163	01121	CB4735	REF		
U1	IC, VOLT. COMP., HI-SPEED	386920	12040	LM361N	1	1	
U2	IC, DUAL D F/F	320804	01295	SN74H74N	1	1	
U3	IC, OP AMP	271502	12040	LM301A	1	1	
U4	IC, MOS, QUAD NOR GATES	355172	02735	CD4001AE	1	1	
U5	IC, QUAD, BILATERAL SW	363838	02735	CD4016AE	1	1	
U6	IC, POS. NAND BUFFER	296228	01295	SN7437N	1	1	
W1	CABLE	419440	89536	419440	1		

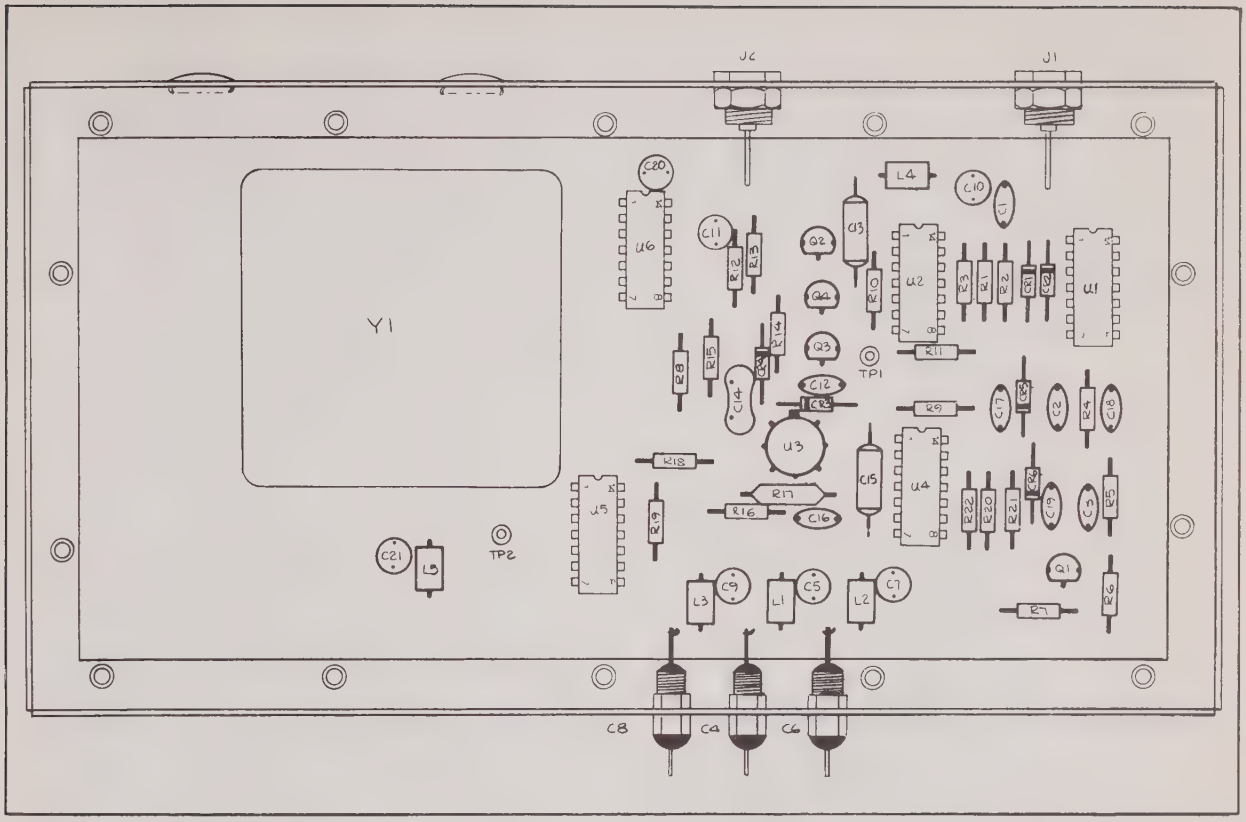

Figure 602-3. Phase Locked Input Option Component Location

Option -03
Frequency Modulation

603-1. INTRODUCTION

603-2. The Frequency Modulation option provides control of frequency deviation about the Model 6011A programmed output frequency. The voltage of the control signal determines the deviation in programmed frequency. Control signal range of ±5V corresponds to changes in programmed frequency of ±20 kHz in HIGH range and ±200 Hz in LOW range. Modulation rate is controlled by the frequency of the control signal (DC to 10 kHz). Frequency modulation may be enabled or disabled by local or remote programming. The -03 Frequency Modulation option is mutually exclusive with the -02 Phase Lock Input option. The -03 Frequency Modulation option may be ordered as a field installable kit- model number 6010/6011-03K. Circuit details are provided by the FM Oscillator PCB Schematic.

603-3. THEORY OF OPERATION

603-4. The theory of operation is supported by Figure 603-1, Frequency Modulation Option Block Diagram. The control signal applied through the FM IN connector on the rear panel of the Model 6011A is applied to a unity gain buffer amplifier. The output of the buffer amplifier is the control voltage of the FM VCXO. The output of the FM VCXO is either enabled or disabled by the programming function FM. If FM is programmed ON, the output of the FM VCXO is shaped into a TTL compatible rf output signal and an FM CONTROL signal is generated.

603-5. INSTALLATION

603-6. Use the following procedure to install the -03 Option in the 6011A. Refer to Figure 603-2 for the location of items referenced in the procedure:

1. Remove the top cover from the 6011A.

2. Swing the Input/Output Module out. (Remove six screws "A" and loosen two screws "B".)

3. Secure the BNC connector on the 21-inch cable (item 4) into the 6011A rear panel opening marked FM IN and lay the cable along the Main PCB toward the front of the 6011A.

4. Plug one end of the 29-inch con-hex to con-hex cable (item 3) into J4 on the Input/Output Module. Place the cable into the cable retainers on the cover of the Input/Output Module then along the Main PCB toward the front of the 6011A.

5. Lower the FM module (item 1) into the 6011A chassis.

6. Route the module power cable under the Attenuator module to the back of the Main PCB and plug it into J8.

7. Plug the rf cable connector to the FM IN jack, into J3 on the FM module. Plug the rf cable connected to J4 on the Input/Output Module, into J2 on the FM module.

8. Secure the FM module in place with the four screws (item 2) provided.

9. Replace the Input/Output module and top cover.

603-7. TROUBLESHOOTING

603-8. Use the following procedure to gain access to the Frequency Modulation PCB then refer to Table 603-1, Fault Isolation Guide, for troubleshooting.

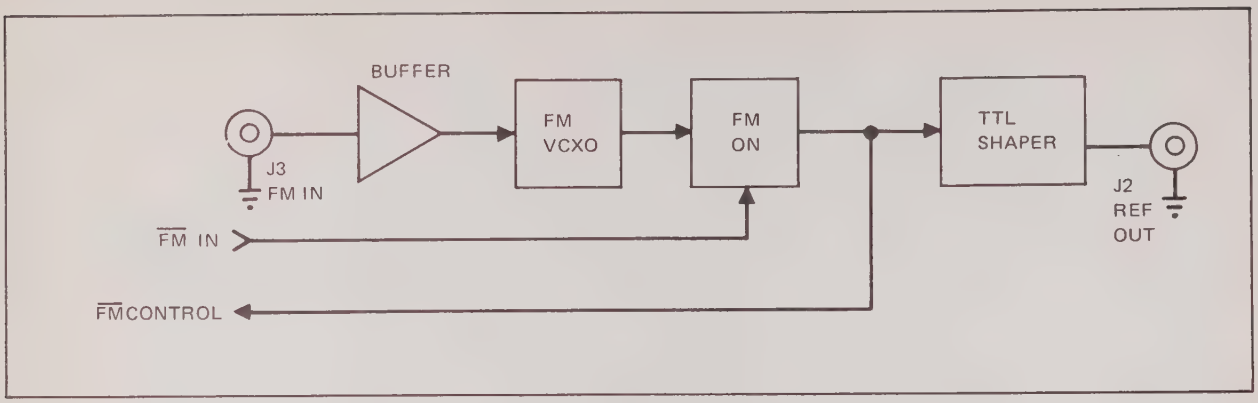

Figure 603-1. FM Option Block Diagram

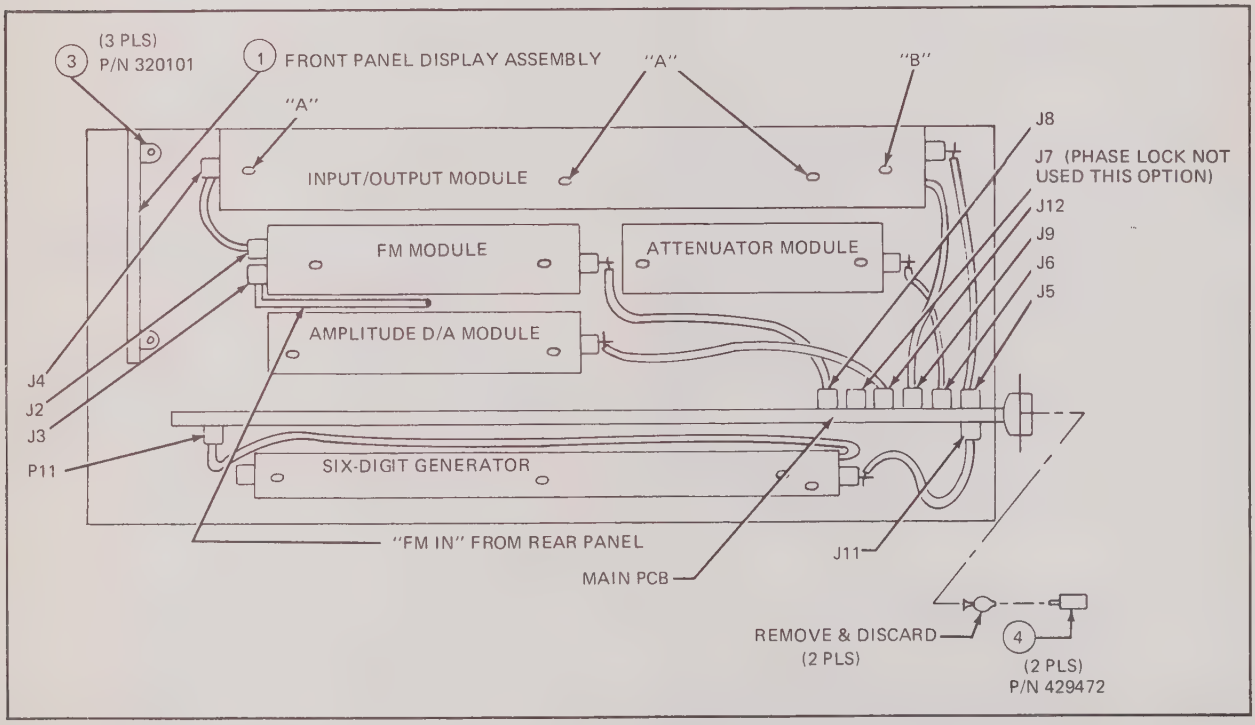

Figure 603-2. FM Module Installation

1. Unplug the 6011A from line power and remove the top dust cover.

2. Swing the Six-Digit Generator module out to access the internal modules.

3. Remove the four screws holding the FM Oscillator module in place and lift it free of the 6011A chassis.

4. Remove the top cover of the module and place some insulating material between the module and the chassis.

5. Connect the 6011A to line power and turn it on.

603-9. -03 OPTION, LIST OF REPLACEABLE PARTS

603-10. For column entry explantions, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the -03 Option is provided in Tables 603-2 and 603-3. These tables are illustrated by Figure 603-3 and 603-4, respectively.

Table 603-1. Fault Isolation Guide

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Program the Model 6011A for an output of 10 MHz at 5V rms, TERM.			2
2	Does the FM indicator illuminate when the FM control is pressed?	x		10
			x	3
3	Is the FM Module correctly installed (all cables and connectors too)?	x		4
			x	5
4	Does the level at C15 on the FM Module toggle between a TTL high and a TTL low when the FM control is repeatedly pressed and released?	x		6
			x	7
5	Troubleshoot and repair.			2
6	Is the annunciator DS15 on the front panel operating properly?	x		10
			x	5
7	Does the level at C14 on the FM Module toggle between a TTL high and low when the FM control is repeatedly pressed and released?	x		8
			x	9
8	The fault is U1 or U2 on the FM Module. Troubleshoot and repair.			2
9	The fault is U25 or U27 on the Main PCB. Troubleshoot and repair.			2
10	Does the frequency counter connected through a 50Ω termination to the 10 Hz-11 MHz output indicate 10 MHz ±1.5 kHz with the FM IN connection grounded?	x		13
			x	11
11	Is the outptu of J2 on the FM Module 10 MHz TTL with FM on?	x		12
			x	17
12	Is the voltage at pin 3 of the FM VCXO 0 ±15 mV?	x		13
			x	15
13	Can the FM VCXO be adjusted for an indication on the counter of 10 MHz ±100 Hz?	x		21
			x	15
14	Replace the FM VCXO.			2
15	Is the voltage across R1 on the FM Module 0 ±1 mV?	x		16
			x	2
16	Replace the FM VCXO.			2
17	Is there a 10 MHz TTL signal on U1-11?	x		18
			x	19
18	Replace U2.			2
19	Is there a 10 MHz TTL signal on pin 2 of the FM VCXO?	x		20
			x	14
20	Replace U1.			2
21	Does the counter indicate 10.02 MHz ±1 kHz +5V dc applied to FM IN?	x		22
			x	14
22	Does the counter indicate 9.98 MHz ±1 kHz with −5V dc applied to FM IN?	x		23
			x	14
23	Remove test equipment.			

Table 603-2. FM Module Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A8	FM MODULE ASSEMBLY FIGURE 603-3 (6010A-4107)	391045	89536	391045	1		
A8A1	FM OSCILLATOR PCB ASSY	ORDER	NEXT	HIGHER ASSY			
H1	SCREW, PHP, 4-40 X 1/4	129890	73734	19022	5		
H2	SCREW, PHP, 4-40 X 5/16	152116	73734	19023	1		
H3	WASHER, SPLIT-LOCK, #4	185710	89536	185710	1		
H4	WASHER, FLAT, #4	146225	86928	5710-18-32	1		
MP1	COVER, INNER	323204	89536	323204	1		
MP2	COVER, OUTER	426718	89536	426718	1		
MP3	NAMEPLATE	405274	89536	405274	1		

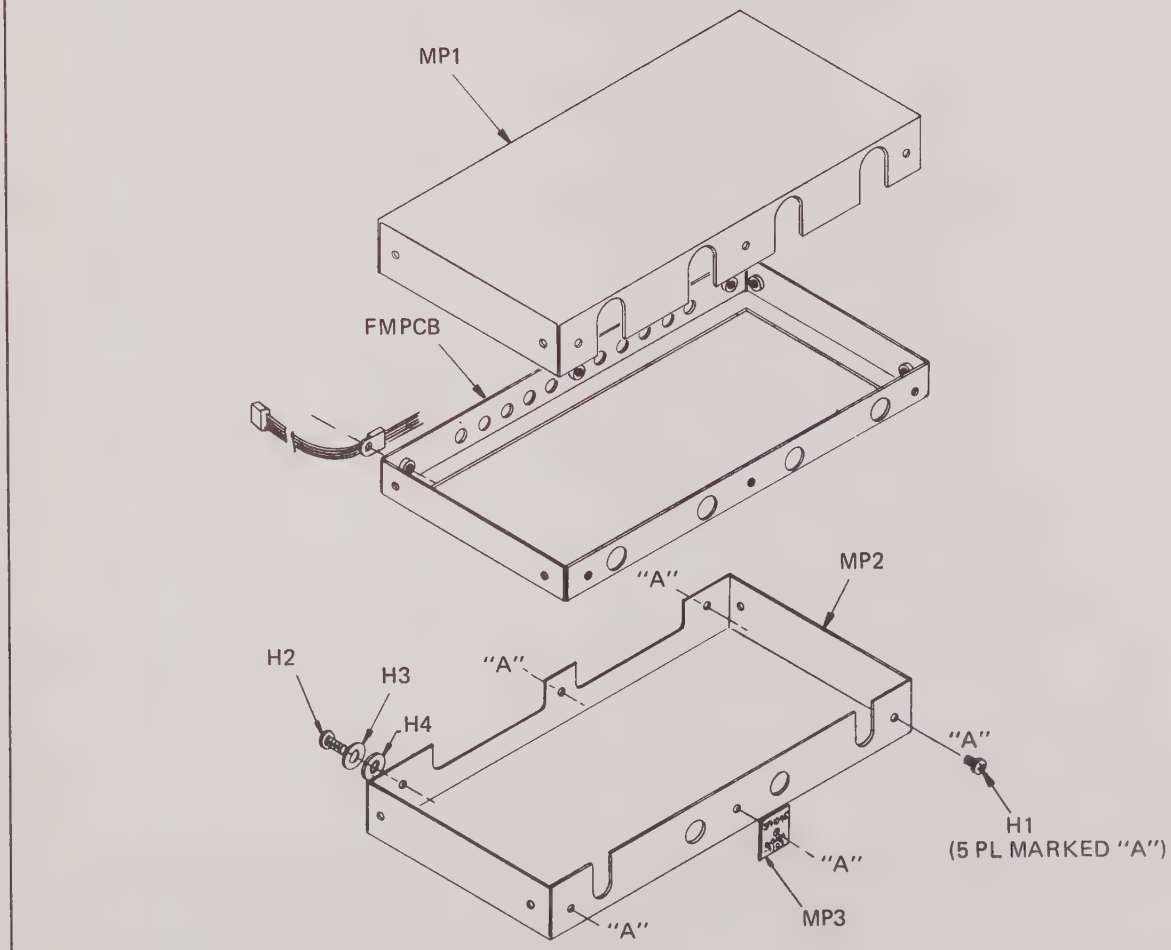

Figure 603-3. FM Module Component Location Guide

Table 603-3. FM Oscillator PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A8A1	FM OSCILLATOR PCB ASSY	ORDER	NEXT	HIGHER ASSY			
	FIGURE 603-4 (6010A-4007)						
C1	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	8		
C2	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C3	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C4	CAP, MICA, 33PF +/-5%, 500V	160317	72136	DME15330J	1		
C5	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C6	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C7	CAP, CER, 300PF +/-10%, 500V	105734	71590	BB60301KW7W	1		
C8	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C9	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C10	CAP, TA, 2.2UF +/-20%, 20V	161927	56289	1960225X0020HA1	REF		
C11	CAP, FEED THRU, 2500PF GVM, 500V	248286	72982	2499-003X5U-252AA	5		
C12	CAP, FEED THRU, 2500PF GVM, 500V	248286	72982	2499-003X5U-252AA	REF		
C13	CAP, FEED THRU, 2500PF GVM, 500V	248286	72982	2499-003X5U-252AA	REF		
C14	CAP, FEED THRU, 2500PF GVM, 500V	248286	72982	2499-003X5U-252AA	REF		
C15	CAP, FEED THRU, 2500PF GVM, 500V	248286	72982	2499-003X5U-252AA	REF		
H1	CLAMP, CABLE	104406	89536	104406	1		
H2	TIE, CABLE	172080	06383	SST-1	1		
H3	GROMMET, RUBBER	135269	83330	2172	1		
H4	RIVET	103424	12014	R3647X5-32	1		
J2	CONN	207639	98291	51-049-0000	1		
L1	INDUCTOR, RF, 6T	320911	89536	320911	6		
L2	INDUCTOR, RF, 6T	320911	89536	320911	REF		
L3	INDUCTOR, RF, 6T	320911	89536	320911	REF		
L4	INDUCTOR, RF, 6T	320911	89536	320911	REF		
L5	INDUCTOR, RF, 6T	320911	89536	320911	REF		
L6	INDUCTOR, RF, 6T	320911	89536	320911	REF		
MP1	FRAME, MODULE, INNER	323196	89536	323196	1		
P8	CABLE	419432	89536	419432	1		
R1	RES, MF, 604 +/-1%, 1/8W	320309	91637	CMF556040F	1		
R2	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	CMF554992F	4		
R3	RES, COMP, 4.7K +/-5%, 1/4W	148072	01121	CB4725	1		
R4	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	CMF554992F	REF		
R5	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	CMF554992F	REF		
R6	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	1		
R7	RES, COMP, 100 +/-10%, 1/4W	193185	01121	CB1011	1		
R8	RES, MF, 49.9K +/-1%, 1/8W	268821	91637	CMF554992F	REF		
U1	IC, TTL, MSI, QUAD 2-INPT P/N GATE	393033	01295	SN74LS00N	1	1	
U2	IC, QUAD, POS NAND GATE	293068	01295	SN74H00N	1	1	
U3	IC, OP AMP	271502	12040	LM301A	1	1	
W1	CABLE, RFC	346411	89536	346411	1		
Y1	OSCILLATOR, VCXO	447581	21962	271-2996	1		

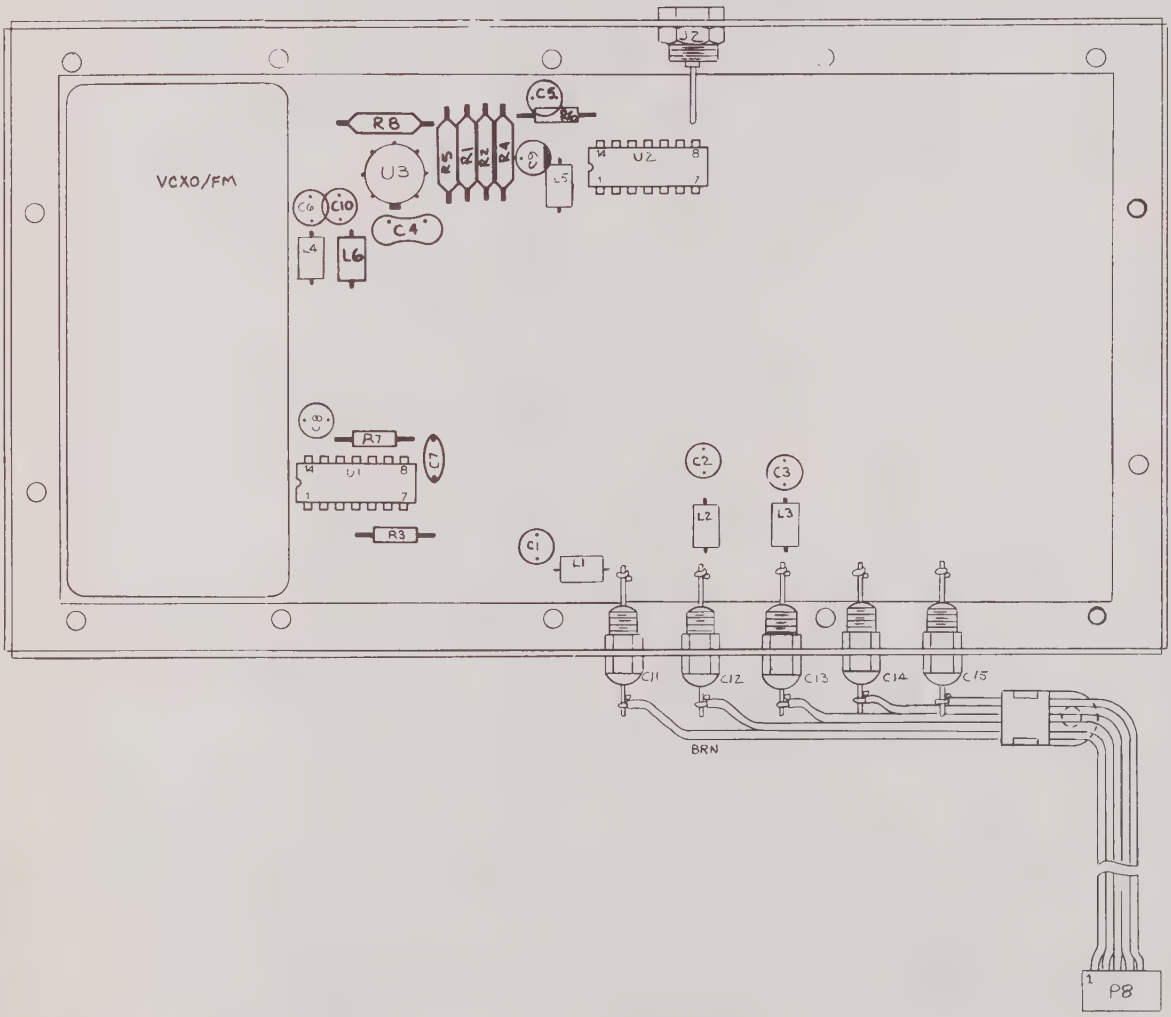

Figure 603-4. FM Oscillator PCB Component Location

Option -04
Rear Panel Output

604-1. INTRODUCTION

604-2. The Model 6011A 10 Hz-11 MHz output is available at the rear panel when equipped with the -04 Option. The specifications for the instrument equipped with the -04 Option are the same as the standard Model 6011A. Calibration procedures are modified only by the fact that connection to the 10 Hz-11 MHz output signal must be made to the rear panel SYNTH OUTPUT connector instead of the front panel 10 Hz-11 MHz connector. This is a factory installed option.

604-3. OPERATION

604-4. Normal operation of the 6011A is not affected by the -04 Option.

Option -05
IEEE-488-1975
Interface Standard

605-1. INTRODUCTION

605-2. A Model 6011A with the -05 interface option installed is compatible with equipment using the IEEE-488-1975 Interface Standard. This option may be field installed by ordering kit model number 6010/6011 -05K. The two interface options, -05 and -06, are mutually exclusive. A copy of the IEEE 488-1975 Interface Standard may be obtained for a nominal fee from:

The Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, N.Y. 10017

605-3. The Model 6011A-05 as defined for IEEE Standard operation is a listen only device that does not use the EOI or SRQ lines nor the DIO8 data line. Data transfer is accomplished through an Acceptor Handshake if the data on the data lines is preceded by the correct My Listen Address (MLA). Defining the Acceptor Handshake operation is covered under the following Theory of Operation section. Programming may be in either fixed or free format.

605-4. PROGRAMMING

605-5. There are two selectable parameters in this option. They are listen address and program format.

605-6. My Listen Address

605-7. The MLA term generated on the interface pcb is made up of the Listen code (L2), five bit MLA code (as defined by IEEE Standard), and the ATN term. The eight DIO lines are time shared for both addressing and data transmission. Table 605-1, Time Sharing of Data Lines, lists the use of each data line for both modes. The two L codes arrive on DIO6 and DIO7. As the Listen code is L2, the terms DIO7 and DIO6 are hard wired into the logic gate that generates the interface MLA term. The MLA code bits arrive on DIO1 through DIO5. Coding their state into the interface MLA generator is manually accomplished by setting the position of the five micro-switches on U14. These switches are factory set for an MLA of 19. Table 605-2, Allowable Listen Addresses, lists the other IEEE Standard legal listen addresses. Figure 605-1, Location of MLA and Format Switches, shows the physical location of the MLA switches on the interface pcb. Access to the pcb may be obtained by removing the top dust cover.

605-8. Program Format

605-9. Program format may be selected as fixed or free by the FIXED/FREE switch S1. Physical location of the switch on the interface pcb is shown in Figure 605-1, Location of MLA and Format Switches. Access to this switch may be obtained by removing the top dust cover.

Table 605-1. Time Sharing of Data Lines

DIO LINE	MLA	DATA
DIO8	Not used	Not used
DIO7	1*	Copy Data
DIO6	0*	Copy Data
DIO5	@	Copy Data
DIO4	@	Copy Data
DIO3	@	Copy Data
DIO2	@	Copy Data
DIO1	@	Copy Data

* Hardwired on interface pcb after data pick-off point.

@ Factory coded for MLA of 19. For other allowable addresses see Table 605-2, Allowable Listen Addresses.

Table 605-2. Allowable Listen Addresses

BINARY NO.	DOI5	DOI4	DOI3	DOI2	DOI1	ASCII	CHARACTER
0	0	0	0	0	0	SP	Space
1	0	0	0	0	1	!	exclamation mark
2	0	0	0	1	0	"	quotation mark
3	0	0	0	1	1	#	pound mark
4	0	0	1	0	0	$	dollar sign
5	0	0	1	0	1	%	per cent
6	0	0	1	1	0	&	and
7	0	0	1	1	1	'	apostrophe
8	0	1	0	0	0	(	left parenthesis
9	0	1	0	0	1	)	right parenthesis
10	0	1	0	1	0	*	asterisk
11	0	1	0	1	1	+	plus
12	0	1	1	0	0	,	comma
13	0	1	1	0	1	–	minus
14	0	1	1	1	0	.	decimal point
15	0	1	1	1	1	/	slant bar
16	1	0	0	0	0	0	zero
17	1	0	0	0	1	1	
18	1	0	0	1	0	2	
* 19	1	0	0	1	1	3	
20	1	0	1	0	0	4	
21	1	0	1	0	1	5	
22	1	0	1	1	0	6	
23	1	0	1	1	1	7	
24	1	1	0	0	0	8	
25	1	1	0	0	1	9	
26	1	1	0	1	0	:	colon
27	1	1	0	1	1	;	semicolon
28	1	1	1	0	0	<	less than
29	1	1	1	0	1	=	equals
30	1	1	1	1	0	>	greater than

*Factory setting

605-10. Parameter Programming

605-11. The various programmable parameters and their formats and options are described in Section 2 of this manual under remote programming.

605-12. THEORY OF OPERATION

605-13. The theory of operation is intended to define the basic control terms and functional component groups as an aid in programming and troubleshooting. Data will

Table 605-3. IEEE Mnemonic Codes - Definitions and Direction of Flow

TERM	DEFINITION	FLOW DIRECTION EXTERNAL CONTROLLER / INTERFACE PCB	MODEL 6011A CONTROLLER
$\overline{REN}$	Remote Enable	→	
$\overline{ATN}$	Attention	→	
$\overline{RFD}$	Ready For Data	←	
$\overline{DAC}$	Data Accepted	←	
$\overline{DAV}$	Data Valid	→	
$\overline{IFC}$	Interface Clear	→	
$\overline{SRQ}$	Not Used		
$\overline{EOI}$	Not Used		
DIO1	DATA INPUT TO INTERFACE	→	
DIO2			
DIO3			
DIO4			
DIO5			
DIO6			
DIO7			
DIO8			
ADB1	DATA TO INPUT/OUT CIRCUIT ON MAIN PCB	←	
ADB2			
ADB3			
ADB4			
ADB5			
ADB6			
ADB7			
ADB8			
REM	Remote Enabled	→	
BSY	6011A Controller Busy	←	
CLK	1 MHz Model 6011A Clock	←	

be processed into the Model 6011A only if it is in the remote listen mode. The other modes possible and the logic gating to enter this mode are described in the theory of operation. The mnemonics of this interface are discussed in Table 605-3, IEEE Mnemonic Codes - Definitions and Direction of Flow. The theory of operation is illustrated by the IEEE-488 Bus Interface schematic.

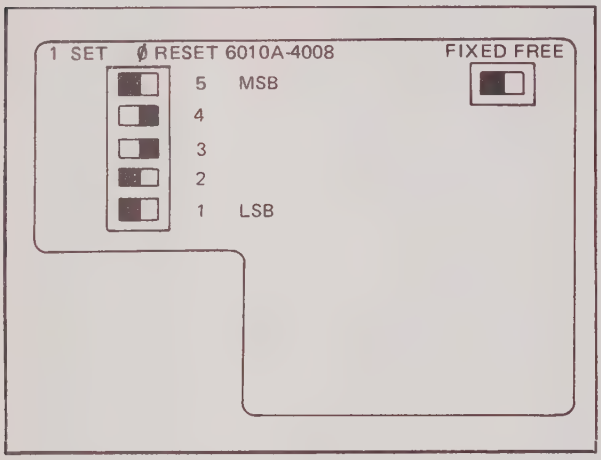

Figure 605-1. Location of MLA and Format Switches

605-14. Interfacing between a remote controller and the 6011A-05 via the IEEE-488 bus is handled by four interface bus transfer integrated circuits, U4 through U7. For the 6011A to become a listener for a remote controller, the following conditions must be met. Remote Enable (REN) must go Low. Then the listen address, as specificed earlier in this discussion, must be placed on the DIO7 through DIO1 lines. This address must be accompanied by the Attention (ATN) line going Low. With these conditions present, the Address Decoder, U1, will provide a High condition to the Listen and Remote circuits, U9 pins 1 and 8 respectively. Also, the ATN line going Low will enable the interface bus transfer circuit, U6, the Ready for Data (RFD) circuit, U13-3, and the Data Accepted (DAC) circuit, U3-10. When U6 is enabled, the RFD line will be driven High by U13-3. A short time after the remote controller senses RFD High, it will drive the Data Valid (DAV) line Low. This will clock the Listen and Remote circuits (U9) changing their states and condition the RFD and DAC circuits. Changing the state of U9-6 to a Low will condition the 6011A for remote operation and changing U9-3 to a High will condition the instrument as a listener. The first clock pulse at J1-5, after DAV is present, will change the state of U13-2 and 3. This results in RFD being driven Low. The Low at U13-2 is gated with a Low on the Busy (BSY) line to provide a High to U13-8. On the second clock pulse, after DAV is present, U13-6 will go Low. This Low is gated with the Low at U13-2 to drive the Data Accepted (DAC) line High. When the remote controller senses DAC High, it will then drive ATN and DAV High. The next clock pulse at J1-5 will return the U13 circuits to their original condition. This drives DAC Low and RFD High. The 6011A is now a listener awaiting program information from the remote controller.

605-15. All codes placed on the IEEE-488 bus will be processed in the following manner provided they are NOT accompanied by the ATN line going Low. Refer to Figure 605-2 and Table 605-4 for the timing and events of the handshake. A code is placed on the bus by the remote controller. Since RFD is High, there will be a short delay, then DAV will be driven Low by the controller. This will condition the RFD and DAC circuits, U13. The first clock pulse at J1-5, after DAV is present, will change the state of U13-2 and 3. U13-3 going High will drive RFD Low. Since ATN remains High, U13-2 going Low will drive the Data Ready (DRY) line High at J2-1. DRY going High indicates to the 6011A that there is data to be processed and causes the Busy (BSY) line to go High at J2-2. This disables U13-8 until the BSY line is cleared Low indicating that the data has been processed. The first clock, after BSY goes Low, will change the state of U13-6 causing the DAC line to be driven high. When this is sensed by the controller, DAV will be driven High. The next clock pulse will then clear the U13 circuits causing DAC to go Low and RFD to go High.

605-16. The universal command for Unlisten (1000000 in Positive True Logic at the IEEE-488 bus), when applied to the DIO7 through DIO1 lines and accompanied by ATN, will cause the Unlisten gate, U2-8, to provide a High to U9-4. When DAV is driven Low, a short time later, U9-3 will go Low. This disables the U6 circuit so a handshake cannot be completed. Therefore, this instrument is no longer a listener even though it is still in Remote. It is necessary to address the instrument again to make it become a listener, if it is desired to control the instrument remotely or return it to Local. The instrument may also be placed in the Unlisten condition by the Interface Clear (IFC) line being driven Low by the remote controller.

605-17. Another universal command that will be recognized by the 6011A-05, when it is operating as a remote listener, is the Go To Local Command (1111110 in Positive True Logic on the IEEE-488 bus). When this code is presented on the DIO7 through DIO1 lines and accompanied by ATN going Low, U3-8 will go Low. If the instrument is a listener, indicated by U9-2 being Low, U9-11 will go High. When DAV is driven Low, U9 will be clocked causing U9-6 to go High. This disables the Remote line to the 6011A instrument and it will return to a Local operation. Additionally, the Remote line will go High if REN is driven High by the remote controller.

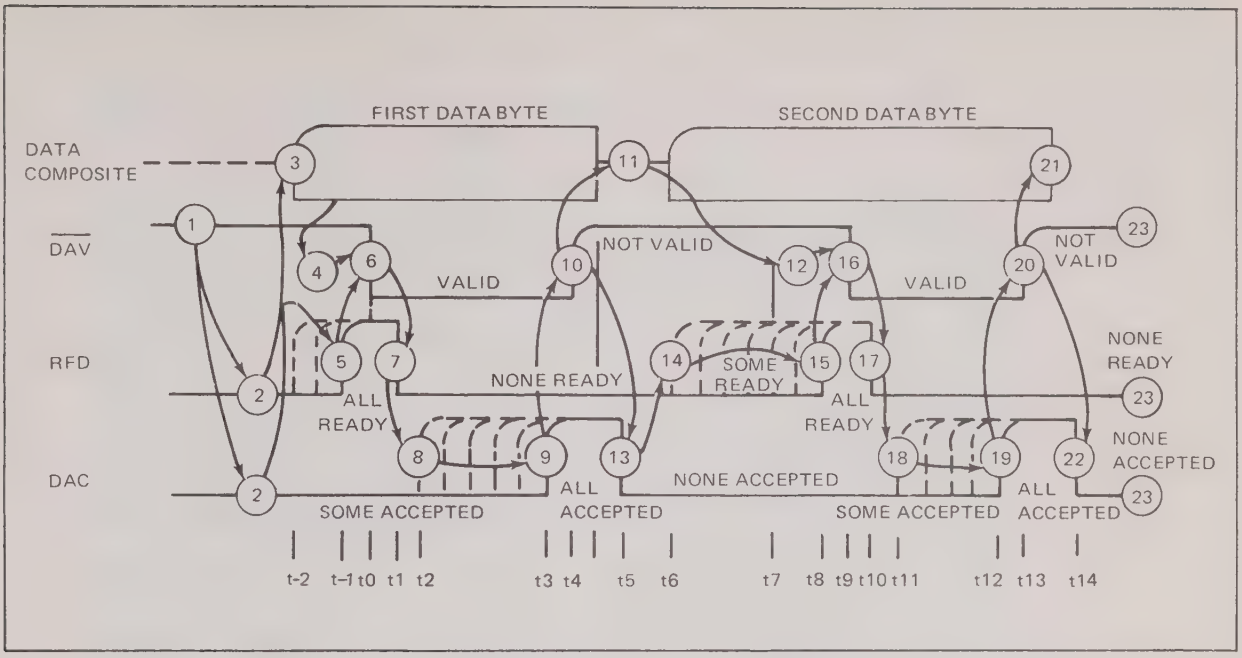

Figure 605-2. Timing Sequence for One Talker and Multiple Listeners Using Handshake Process

605-18. INSTALLATION

605-19. Use the following procedure to install the -05 Option in the 6011A. Refer to Figure 605-3 for the location of items referenced in the procedure.

1. Remove the 6011A top dust cover.

2. Swing Input/Output module out. (Remove six screws "A" and loosen two screws "B".)

3. If the 6011A is equipped with the FM or Phase Lock Input option, remove the mounting screws and swing the modules back out of the way.

4. Install the IEEE-488 Option (item 1). Secure it in place with three flat head screws (item 3).

5. Remove 100Ω and 33Ω resistors from J10 and discard.

6. Plug in cable assembly, P/N 442715, (item 2). Connect as follows:

IEEE	MAIN PCB
J1	J10
J2	XU45
J3	XU44

7. Replace FM or Phase Lock Input modules if removed.

8. Swing Input/Output module into place and secure it.

9. Replace top dust cover.

10. On the rear panel remote connector, remove screws that hold latching bail and discard screws and bail. Install connection mounting screws (item 4) in their place.

605-20. TROUBLESHOOTING

605-21. In the event that the 6011A fails to operate correctly from the remote control station, the instrument should be operated locally (front panel controls) in order to determine whether the problem is in the basic 6011A or the -05 Option. If the instrument operates correctly from the front panel controls, the malfunction is likely to be found in the -05 Option.

605-22. The step-by-step procedure provided in Table 605-5 will aid in isolating a malfunction in the -05 option circuitry.

605-23. -05 OPTION LIST OF REPLACEABLE PARTS

605-24. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the -05 option is provided in Table 605-6. This table is illustrated by Figure 605-4.

Table 605-4. List of Events for Handshake Process

STEP	TIME	EVENT
(1)	–	Source initializes DAV to high (H) (data not valid).
(2)	–	Acceptors initialize RFD to low (L) (none are ready for data), and set DAC to to low (L) (none have accepted the data).
(3)	t–2	Source checks for error condition (both RFD and DAC high), then sets data byte on DIO lines.
(4)	t–2 → t0	Source delays to allow data to settle on DIO lines.
(5)	t–1	Acceptors have all indicated readiness to accept first data byte; RFD line goes high.
(6)	t0	Source, upon sensing RFD high, sets DAV low to indicate that data on DIO lines is settled and valid.
(7)	t1	First acceptor sets RFD low to indicate that it is no longer ready, then accepts the data. Other acceptors follow at their own rate.
(8)	t2	First acceptor sets DAC high to indicate that it has accepted the data. (DAC remains low due to other acceptors driving DAC low.)
(9)	t3	Last acceptor sets DAC high to indicate that it has accepted the data; all have now accepted and the DAC line goes high.
(10)	t4	Source, having sensed that DAC is high, sets DAV high. This indicates to the acceptors that data on the DIO lines must now be considered not valid.
(11)	t4-t7	Source changes data on the DIO lines.
(12)	t7-t9	Source delays to allow data to settle on DIO lines.
(13)	t5	Acceptors, upon sensing DAV high (at 10) set DAC low in preparation for next cycle. DAC line goes low as the first acceptor sets the line low.
(14)	t6	First acceptor indicates that it is ready for the next data byte by setting RFD high. (RFD remains low due to other acceptors driving RFD low.)
(15)	t8	Last acceptor indicates that it is ready for the next data byte by setting RFD high; RFD signal line goes high.
(16)	t9	Source, upon sensing RFD high, sets DAV low to indicate that data on DIO lines is settled and valid.
(17)	t10	First acceptor sets RFD low to indicate that it is no longer ready, then accepts the data.
(18)	t11	First acceptor sets DAC high to indicate that it has accepted the data as in (8).
(19)	t12	Last acceptor set DAC high to indicate that it has accepted the data as in (9).
(20)	t13	Source, having sensed that DAC is high, sets DAV high as in (10).
(21)		Source removes data byte from DIO signal lines after setting DAV high.
(22)	t14	Acceptors, upon sensing DAV high, set DAC low in preparation for next cycle.
(23)		Note that all three handshake lines are at their initialized states as in (1) and (2).

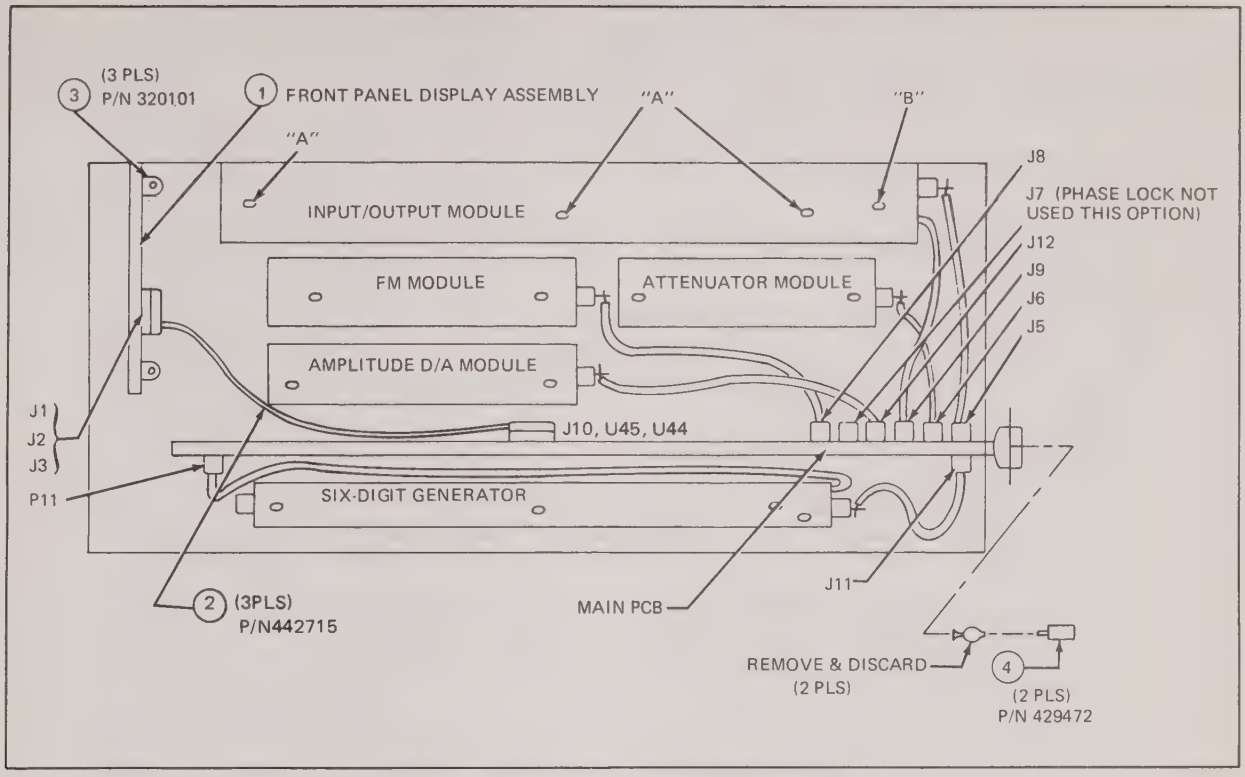

Figure 605-3. IEEE-488 Interface Installation

Table 605-5. IEEE-488 Interface Troubleshooting Procedure

STEP NO.	INSTRUCTION	YES	NO	GO TO
	SELECTING REMOTE			
1	Ground J4-14, 13, 2, 1 (Address 19) and 11 (ATN). Is U1-8 low?	x		4
			x	2
2	Are the U14 switches set for the correct address? (Binary 19 for the condition of item No. 1.)	x		6
			x	3
3	Set the U14 switches for the correct address. (Binary 19 for the conditions of item No. 1.)			
4	Is U9-1 and 8 high?	x		8
			x	5
5	U10 is the faulty device.			
6	Are the input to U1 high?	x		7
			x	14
7	U1 is the faulty device.			
8	Ground J4-17 (REN). Is U9-10 and 13 high?	x		9
			x	15
9	Is J4-7 (RFD) high and J4-8 (DAC) low?	x		10
			x	52

Table 605-5. IEEE-488 Interface Troubleshooting Procedure (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
10	Ground J4-6 (DAV). Did U9-2 and 6 go from high to low?	x		11
			x	16
11	Did U9-3 and 5 go from low to high?	x		12
			x	16
12	Is J4-7 (RFD) low and J4-8 (DAC) high?	x		13
			x	19
13	Remove ground from J4-11 (ATN) only. Did U6-12 remain low?	x		17
			x	21
14	Check U4, 5, 8 and 11. One of these devices is faulty.			
15	Check U7, 10 and 11. One of these deivces is faulty.			
16	Check applicable portion of U7, 9, 10 and 11. One of these devices is faulty.			
17	Remove ground from J4-6 (DAV). Did J4-7 (RFD) go high and J4-8 (DAC) go low?	x		18
			x	22
18	–05 Option is completing handshake and becoming remote listener correctly. Check interconnecting cables for malfunction.			
19	Are clock pulses present at J1-5?	x		20
			x	25
20	U13 is likely the faulty device.			
21	U12 is likely the faulty device.			
22	Is J2-2 low?	x		23
			x	26
23	Are clock pulses present at J1-5?	x		24
			x	25
24	Check applicable portions of U6, 11, 12, 13 and 18. One of these devices has malfunctioned.			
25	Malfunction is in main 6011A instrument.			
26	Determine why the 6011A microprocessor is still busy.			
	UNLISTEN (remove all grounds except J4-17 (REN)).			
27	Ground J4-14, 13, 4, 3, 2, 1, (Unlisten code) and 11 (ATN). Is U9-4 high?	x		28
			x	30
28	Ground J4-6 (DAV). Did U9-2 go high and U9-3 go low?	x		29
			x	32
29	–05 Option is recognizing the unlisten code correctly.			
30	Is U2-8 low?	x		31
			x	34
31	U11 is the faulty device.			
32	Did U9-12 go from high to low?	x		33
			x	36
33	U9 is the faulty device.			

Table 605-5. IEEE-488 Interface Troubleshooting Procedure (cont)

STEP NO.	INSTRUCTION	YES	NO	GO TO
34	Are all inputs to U2 high?	x		35
			x	38
35	U2 is the faulty device.			
36	Did U6-3 go from low to high?	x		37
			x	39
37	U11 is the faulty device.			
38	Check U4, 5, 8 and 11. One of these devices is faulty.			
39	Check applicable section of U6.			
	GO TO LOCAL (remove all grounds except J4-17).			
40	Ground J4-14, 13, 12, 1 (Listen address binary 19), 11 (ATN) and 6 (DAV). This readdresses the −05 Option to be a listener.			
41	Remove all ground applied in item No. 40.			
42	Ground J4-1 (go to Local code) and 11 (ATN). Did U9-11 go high?	x		43
			x	45
43	Ground J4-6 (DAV). Did U9-5 go low and U9-6 go high?	x		44
			x	48
44	−05 Option is recognizing the Go To Local code correctly.			
45	Is U10-11 low?	x		46
			x	48
46	Is U3-8 low?	x		47
			x	49
47	U10 is the faulty device.			
48	U9 is the faulty device.			
49	Are all inputs to U3 high?	x		50
			x	51
50	U3 is the faulty device.			
51	Check U4, 5, 8 and 11. One of these devices is faulty.			
52	Check U6, 11, 12, and 13. One of these devices is faulty.			

Table 605-6. IEEE-488 General Purpose Interface PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A9	IEEE GENERAL PURPOSE INTERFACE PCB ASSY FIGURE 605-4 (6010A-4008T)	409995	89536	409995	1		
C1	CAP, PLSTC, 0.1UF +/-10%	161992	89536	161992	1		
C2	CAP, ELECT, 10UF +/-10%, 25V	170266	80031	ET100X025A2	1	1	
C3	CAP, CER, 0.22UF	309849	71590	CW30C224K	6		
C4	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C5	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C6	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C7	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C8	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
H1	RIVET	.03424	12014	R3647X5-32	3		
J1	SOCKET, IC, 16 PIN	370312	01295	C931602	3		
J2	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
J3	SOCKET, IC, 16 PIN	370312	01295	C931602	REF		
J4	JACK, TIP	170480	74970	105-752	3		
MP1	BRACKET, ANGLE	306225	73734	36-515	3		
R1	RES, COMP, 390 +/-5%, 1/4W	147975	01121	CB3915	1		
S1	SWITCH, SLIDE, DPDT	393629	10389	23-021-114	1		
U1	IC, POS NAND GATE, 8 INPUT	404889	01295	SN74LS30J	3	1	
U2	IC, POS NAND GATE, 8 INPUT	404889	01295	SN74LS30J	REF		
U3	IC, POS NAND GATE, 8 INPUT	404889	01295	SN74LS30J	REF		
U4	IC, INTERFACE, QUAD BUS RECIEVERS	404103	04713	MC3441P	4	1	
U5	IC, INTERFACE, QUAD BUS RECIEVERS	404103	04713	MC3441P	REF		
U6	IC, INTERFACE, QUAD BUS RECIEVERS	404103	04713	MC3441P	REF		
U7	IC, INTERFACE, QUAD BUS RECIEVERS	404103	04713	MC3441P	REF		
U8	IC, TTL, HEX-INV	393058	01295	SN74LS04J	2	1	
U9	IC, DUAL JK/MS F/F	393157	01295	SN74LS107N	2	1	
U10	IC, POS NOR GATES, QUAD, 2-INPUTS	393041	01295	SN74LS02N	2	1	
U11	IC, TTL, HEX-INV	393058	01295	SN74LS04J	REF		
U12	IC, POS NOR GATES, QUAD, 2-INPUTS	393041	01295	SN74LS02N	REF		
U13	IC, DUAL JK/MS F/F	393157	01295	SN74LS107N	REF		
U14	SWITCH, MODULE, DUAL IN-LINE	417766	00779	435470-4	1	1	
U18	IC, POS AND GATE, QUAD, 2-INPUT	393066	01295	SN74LS08	1	1	

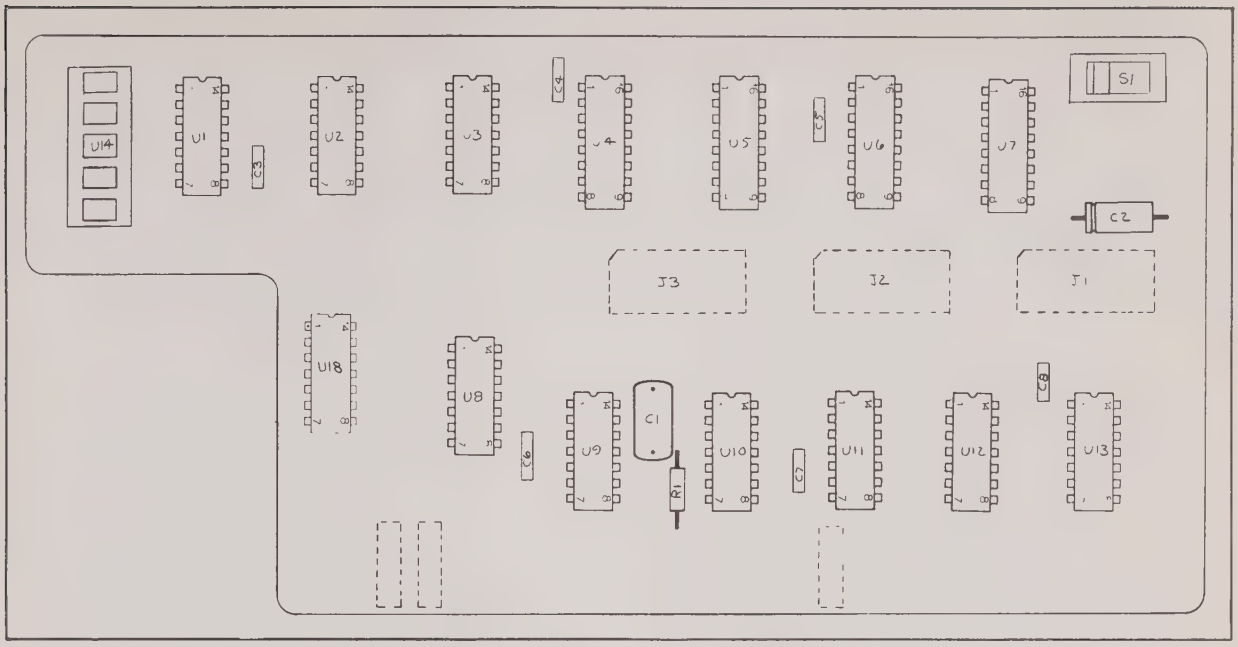

Figure 605-4. IEEE-488 Interface Component Location

Option -06
Remote Programming Interface

606-1. GENERAL

606-2. EIA Standard RS-232-C provides the electronics industry with the ground rules necessary for independent manufacturers to design and produce both data terminal and data communication equipment that conforms to a common interface requirement. As a result, a data communications system can be formed by connecting an RS-232-C data terminal (such as, the 6011A) to an RS-232-C data communication peripheral (such as, a TTY, MODEM, computer, etc.). This works fine on paper. However, in practice the user must be aware of the subtleties of serial binary data interchange to ensure that any two pieces of RS-232-C equipment will be compatible. For example, the two instruments must share at least one of the features from each of the following characteristics.

1. Timing Format - Synchronous or Asynchronous.

2. Transmission Mode - Simplex, half-duplex, or full duplex.

3. Baud Rate (bits per second) - 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600.

4. Bits per character - 5, 6, 7, 8.

5. Parity Bits - Odd, even, hi, low, not used.

6. Data Interface Levels - EIA or 20 mA current loop.

606-3. Timing formats conforming to both synchronous and asynchronous operation are shown in Figure 606-1. In asynchronous operation each character is bracketed by both start and stop bits. These bits separate the characters and synchronize both the transmission and receipt of data. When data is not being sent the data line is held high. In synchronous operation a sync character is sent prior to each data stream (a data stream usually consists of a block of characters). When the line is idle, a fill or sync character is continuously transmitted.

606-4. Transmission mode is an overall system requirement. It defines the communication ability of both instruments in the system configuration. Simplex indicates data transmission in one direction only. Half-duplex permits two way communication, but not simultaneously. Simultaneous transmission of data in both directions defines the full-duplex system. Obviously, an instrument capable of full-duplex operation can be down graded to simplex operation. However, the reverse is not possible without degrading the system capability.

606-5. Baud rate is usually selectable on the RS-232-C Interface. If it is not, the manufacturer usually offers a choice when the instrument is purchased.

606-6. Character format (bits per character and parity) is somewhat flexible between instruments. Investigate the requirement of both instruments before committing either to a system configuration.

606-7. Data interface levels can occur as either EIA voltage levels or as a 20 mA current loop. At times an interface offers both simultaneously. The 20 mA current loop is used almost exclusively for teletypewriter, or paper tape punch/reader interface. EIA voltage levels are: 1 or OFF = -15 to -3V dc, 0 or ON = +3 to +15V dc.

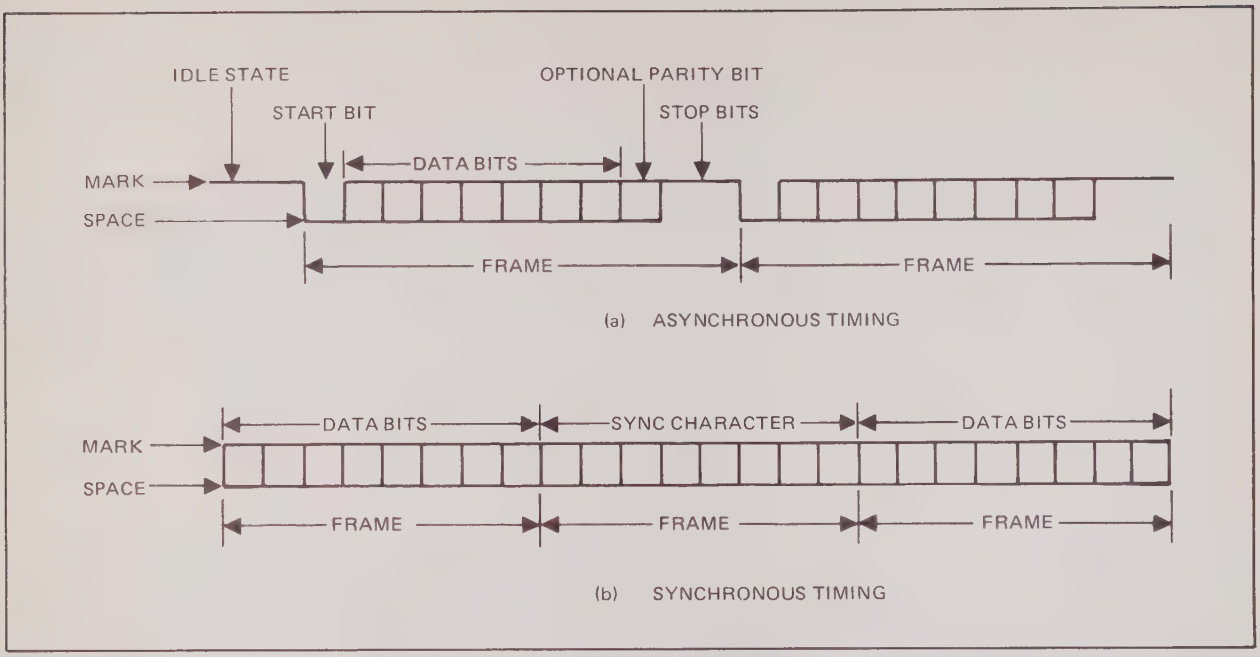

Figure 606-1. RS-232-C Timing Formats

606-8. INTRODUCTION

606-9. The EIA Standard RS-232-C Interface Option -06 is designed to interface the Model 6011A Synthesized Signal Generator with an external, EIA Standard RS-232-C/20 mA current loop compatible data communication instrument (i.e., TTY, MODEM, computer, CRT, etc.). The option features asynchronous timing, half-duplex capability, selectable baud rate, a choice of EIA voltage of 20 mA current loop data level, 7-bit ASCII coding, serial transfer, local or remote programming in fixed or free programming format. The parity bit is not used. This option is mutually exclusive with the -05 Option. The -06 Option is factory installed. Interface cable, P/N 427054, is included.

606-10 SPECIFICATIONS

606-11. Specifications for the -06 Option are as follows:

Timing Format: Asynchronous
Transmission Mode: Half-Duplex
Output Format: Bit Serial
Output Code: Seven Level ASCII
Data Buffer: 32 Characters
Baud Rates: 110, 150, 300, 600, 1200, 2400, 4800, 9600
Parity Bit: Not Used
Data Interface Levels: EIA Voltage or 20 mA Current Loop
Program Format: Fixed or Free
Program Station: Local or Remote
Operating Power: Derived from Model 6011A
Operating Temperature: 0° to 50° C

606-12. MODEL 6011A TO EXTERNAL DEVICE WIRING

606-13. Adapter Cable Pin Assignments for RS-232-C Interface

606-14. Table 606-1, Adapter Cable Pin Assignments, lists the cable pin numbers for both the 24 and 25 pin connectors. The table defines the pins in terms of the Model 6011A and the standard RS-232-C.

606-15. Null Modem

606-16. RS-232-C defines a data communications device such as a modem as the only place a female connector may be used. Because data terminal such as CRT terminals may be used to program the Model 6011A, rewiring of standard connectors may be necessary. To avoid this, a Null Modem may be used. The null modem, provides a means of connecting two EIA RS-232-C compatible devices together without the use of non-standard cables or rewiring of standard connections. The null modem is two female connectors wired back-to-back as shown in Figure 606-2, Null Modem Connections.

Table 606-1. Adapter Cable Pin Assignments

6011A SYNTHESIZED SIGNAL GENERATOR	6010A-4456 ADAPTER ASSEMBLY PIN ASSIGNMENTS		RS-232-C DESCRIPTION		
FUNCTION (REMOTE CONNECTOR J4 ON REAR PANEL	24-PIN CONN. J1	25-PIN CONN. J2	DATA FLOW	CIRCUIT	DESCRIPTION
SDI (Serial Data In)	6	3	←	BB	Rec'd Data
Signal Ground	5	7		AB	Signal Gnd
SDO (Serial Data Out)	7	2	→	BA	Transmitted Data
Send Source+	20	11	→		20 mA Transmitted
Send Return–	23	12	→		Data
Received Source+	12	13	←		20 mA
Received Return–	18	14	←		Received Data
Chassis Ground	24	1		AA	Protective Gnd
Remote Control Format	19 (wired together)	N/C			
Signal Ground	11 (wired together)	N/C			
REM (Remote Control Order)	9 (wired together)	N/C			
	N/C	Wired together 8, 20	← →	CF CD	Rec'd Line Sig. Det. Data Term. Ready
	N/C	Wired together 4, 20	→ ←	CA CB	Request to Send Clear to Send
	N/C	6	←	CC	Data Set Ready
Grounded on Interface Card	17, 21, 22	N/C			
N/C	All other pins	N/C			
	N/C	All other pins			N/C

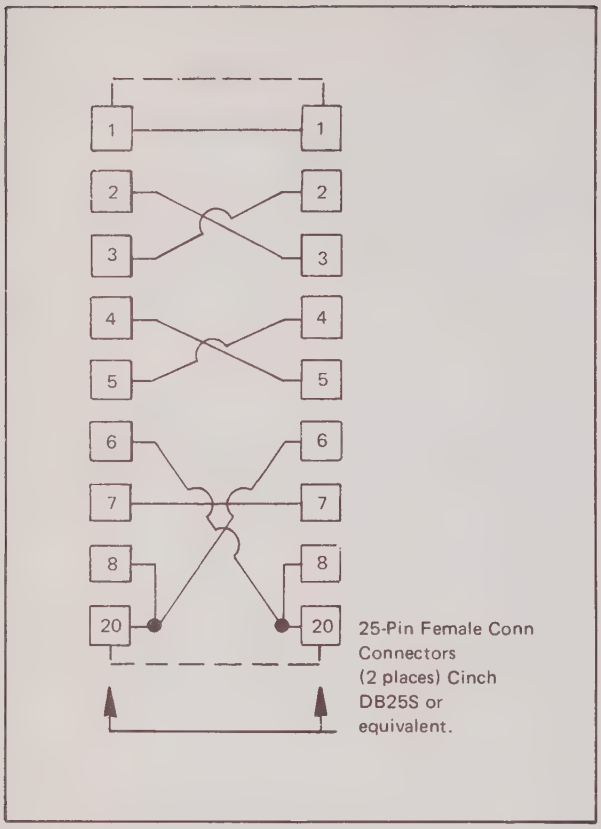

Figure 606-2. Null Modem Connections

606-17. SELECTION OF FUNCTIONS

606-18. Baud Rates (Data Transfer Rates)

606-19. Baud rates of 110, 150, 300, 600, 1200, 2400, 4800, 9600 are selectable by changing the position of the jumper wire in socket X1 on the interface pcb. This pcb is located behind the front panel. Access may be gained by removal of the top dust cover.

606-20. Voltage or Current Interface

606-21. Switch S1 on the interface pcb determines whether the instrument will use EIA voltage or 20 mA current loop data levels. These levels enter the instrument on separate data lines which will be shown later.

606-22. The voltage interface is EIA Standard. The circuits BB and BA are terminated and originated by type 8T16 and 8T15 IC's respectively.

606-23. The 20 mA current loop transmit and receive circuits are shown in Figure 606-3, 20 mA Interface Circuits. These circuits are referenced to chassis ground and require isolated (nongrounded) terminations in the data communications or Teletype equipment. The 20 mA current source is provided with the interface. Be sure there are no additional 20 mA current sources connected with the exterior equipment. The recommended method of connecting the Model 6011A with -06 Option to the Model ASR 33 Teletype without separate reader control hardware is shown in Figure 606-4, Model 6011A-06 to Model ASR 33 Teletype.

606-24. Programming Modes

606-25. PROGRAMMING FORMAT

606-26. The jumper on the connecting cable between pins 19 (FIXED/FREE FORMAT) and 11 (GND) places the format in the free mode. Changing to the fixed format requires removing the back shell from the 25 pin connector and cutting the jumper.

606-27. PROGRAMMING STATION

606-28. The jumper wire on the RS-232-C adapter cable between pins 9 (REM) and 11 (GND) places the Model 6011A in the REMOTE programming mode. To enable selection of programming station, cut the jumper and wire pin 9 to a TTL gate. Pin 9 should rise to +5V when open and allow 2.3 mA to flow out when shorted to ground.

606-29. PROGRAMMED DATA FORMAT

606-30. The factory interface has the data format set up so that there are 9 data bits (one allocated for parity), 1 start bit, 2 stop bits, and parity is ignored. By altering the connections to the UART (U1) as shown in Table 606-2, Data Format, 5, 6, 7, or 8 data bits; odd, even, or no parity; and 1 stop bit or 2 stop bits, may be selected for the data format. These pins come factory wired to +5V. To place a zero, cut the land pattern to the pin and jumper the pin the GND.

606-31. Programming

606-32. Both fixed and free format programming are described in Section 2 of this manual. In addition, provision has been made for status interrogation and response of the Model 6011A controller and for status flags indicating error conditions in programming.

606-33. Status interrogation and response characters are ? and CR. The programming string should end in ?. When the Model 6011A controller has completed computations, the ? is decoded and a CR is generated and transmitted back to the external device.

606-34. The error status flags are coded by the multiplexer IC on the interface pcb. The multiplexer receives invalid frequency programmed, invalid level programmed, ROL - reduce output level (in AM only), and DAS-D/A Settling (following level commands) and converts these signals into a coded 4-bit word shown in Table 606-3, Equipment Status Flags.

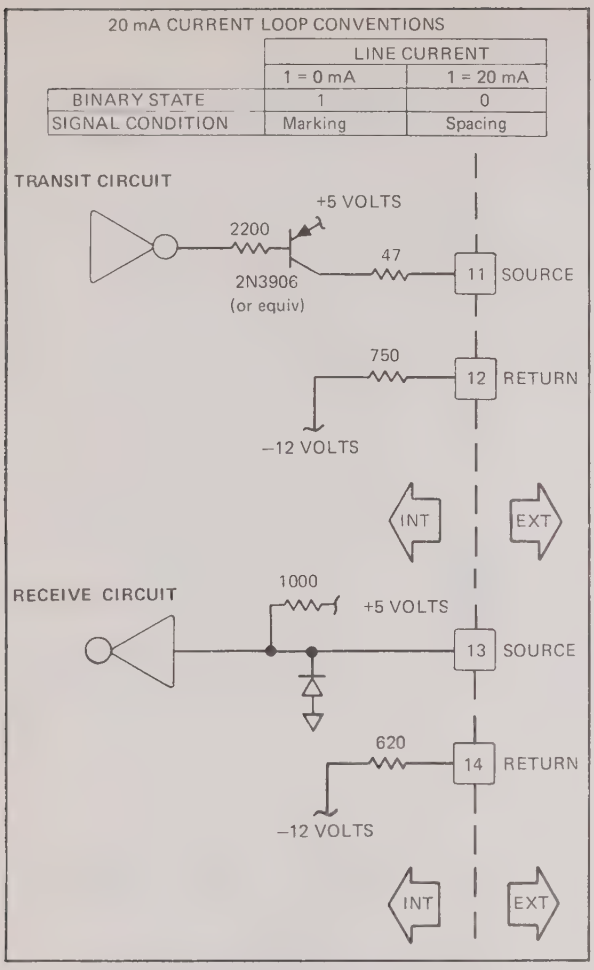

Figure 606-3. 20 mA Interface Circuits

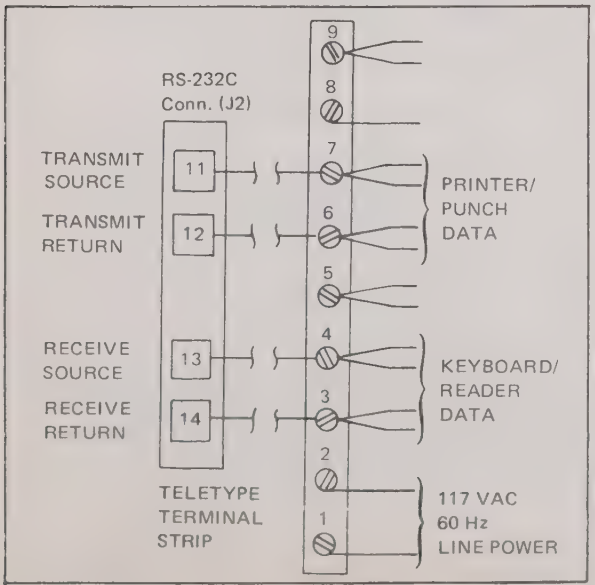

Figure 606-4. Model 6011A-06 to Model ASR33 Teletype

606-35. THEORY OF OPERATION

606-36. The theory of operation of the -06 Option will be restricted to the basic functional description illustrated by Figure 606-5, EIA Standard RS-232-C Interface PCB Block Diagram.

606-37. Data may be either 20 mA current loop or EIA voltage level. The position of S1 determines which. Data received on the interface pcb is sent bit-serially via S1 to the Universal Asynchronous Receiver-Transmitter (UART) where it is converted to eight-bit parallel data and stored in the First In-First Out (FIFO) buffer memory. Because of the 32 bit FIFO, data can be transmitted to the Model 6011A faster than the Model 6011A can transfer routine can handle. The eight bit parallel information is retrieved and processed by the Model 6011A controller as required.

606-38. When the end of the input data string arrives, the last character should be a ?. The controller decodes this character last and returns a CR to let the external device know that it is ready for more data.

606-39. The multiplexer combines the D/A Settling (DAS), Processor Done Strobe (PRD), Reduce Output Level (ROL), incorrect frequency programmed, and incorrect level programmed (DO1 and DO2). The multiplexer sends a four bit coded status flag word through the interface circuit to the external device to notify the external device of programming problems. Table 606-3, Equipment Status Flags, lists the coding of the four bit word.

606-40. Y1, a 1.228 MHz oscillator provides clock and timing frequency for the interface pcb. The output of U1 is reduced by the baud rate generator and baud rate selector to a frequency exactly 16 times the selected baud rate. The selected baud rate must be compatible with the baud rate of the device controlling the Model 6011A.

606-41. TROUBLESHOOTING

606-42. Table 606-4, Fault Isolation Guide, gives a troubleshooting procedure for the RS-232-C Interface PCB.

606-43. -06 OPTION, LIST OF REPLACEABLE PARTS

606-44. For column entry explanations, parts ordering information, and basic instrument configuration, refer to Section 5 of this manual. A list of replaceable parts for the -06 Option is provided in Table 606-5. This table is illustrated by Figure 606-6.

Table 606-2. Data Format

U1 PIN NO.	FUNCTION	NO. of DATA BITS			
		8	7	6	5
38	NB1	1	0	1	0
37	NB2	1	1	0	0
		TYPE OF PARITY			
		NONE		EVEN	ODD
39	EPS	1	0	1	0
35	NP	1	1	0	0
		2 STOP BITS		1 STOP BIT	
36	TSB	1		0	

1 = +5V dc
0 = gnd

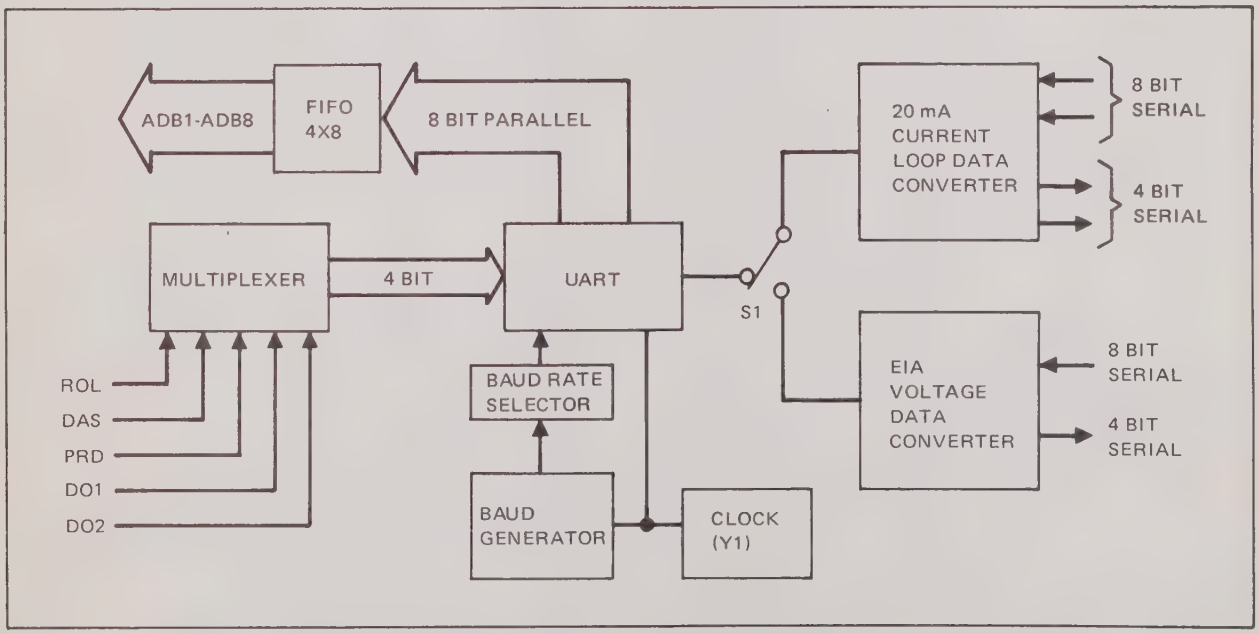

Figure 606-5. EIA Standard RS-232-C Interface PCB Block Diagram

Table 606-3. Equipment Status Flags

ASCII CHAR	STATUS
0	Everything OK
1	*Invalid frequency command
2	*Invalid level command
4	DAS (output level settling)
8	ROL (reduce output level)

* In Free Format only.

Table 606-4. Fault Isolation Guide

STEP NO.	INSTRUCTION	YES	NO	GO TO
1	Is the baud rate selected (jumpered at X1) compatible with the external controller?	x		3
			x	2
2	Select the correct baud rate.			14
3	Is the frequency at TP1 (U8, pin 5) 614 kHz?	x		5
			x	4
4	U15 or U8 is the faulty component. Troubleshoot and repair.			14
5	Is the frequency at U1, pin 40, sixteen times the selected baud rate?	x		7
			x	6
6	U4, U6 and U8 is the faulty component. Troubleshoot and repair.			14
7	Is the data applied to U1, pin 20, correct? (Use an oscilloscope.)	x		9
			x	8
8	U16 for current loop mode or U13 for EIA voltage mode is the faulty component.			
9	Enter the code for?. Are U12, pins 7 and 15, at a low logic level?	x		13
			x	10
10	Are U12, pins 1, 2, 3 and 6 and U17, pins 9, 10 and 11 at a high logic level?	x		11
			x	12
11	U12 or U17 is the faulty component. Troubleshoot and repair.			14
12	U1 or U2 is the faulty component. Troubleshoot and repair.			14
13	Check for logic level changes at U4, pin 6, U5, pin 8, U3, pin 10, U15, pin 8 and U5, pin 6. Troubleshoot and repair as indicated.			14
14	Check the instrument for proper operation. Proceed as the results indicate.			

Table 606-5. RS-232-C Interface PCB Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A10	RS-232C INTERFACE PCB ASSY FIGURE 606-6 (6010A-4010)	425215	89536	425215	1		
C1	CAP, CER, 0.025UF +/-20%, 100V	168435	56289	C023B101H253M	2		
C2	CAP, CER, 0.025UF +/-20%, 100V	168435	56289	C023B101H253M	REF		
C3	CAP, TA, 10UF +/-20%, 10V	176214	56289	196D106X0010KA1	1		
C4	CAP, ELECT, 10UF, 25V	170266	80031	ET100X025A2	3	1	
C5	CAP, ELECT, 10UF, 25V	170266	80031	ET100X025A2	REF		
C6	CAP, ELECT, 10UF, 25V	170266	80031	ET100X025A2	REF		
C7	CAP, CER, 0.22UF	309849	71590	CW30C224K	7		
C8	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C9	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C10	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C11	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C12	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
C13	CAP, CER, 0.22UF	309849	71590	CW30C224K	REF		
CR1	DIODE, SI	375485	09214	MPD300	2	1	
CR2	DIODE, SI	375485	09214	MPD300	REF		
CR3	DIODE, SI, HI-SPEED SW	203323	07910	1N4448	1	1	
H1	TAIL, MOUSE	104794	98159	2829-115-3	1		
H2	CLIP, MOUNTING	306225	73734	36-515	3		
H3	RIVET	103424	12014	R3647X5-32	3		
J1	SOCKET, 16 PIN	370312	01295	C931602	4		
J2	SOCKET, 16 PIN	370312	01295	C931602	REF		
J3	SOCKET, 16 PIN	370312	01295	C931602	REF		
J4	SOCKET, 16 PIN	370312	01295	C931602	REF		
MP1	JACK, TIP	170480	74970	105-752	3		
Q1	XSTR, SI, PNP	195974	04713	2N3906	1	1	
R1	RES, COMP, 51 +/-5%, 1/4W	218032	01121	CB5105	2		
R2	RES, COMP, 51 +/-5%, 1/4W	218032	01121	CB5105	REF		
R3	RES, COMP, 1.1K +/-5%, 1/4W	276336	01121	CB1125	1		
R4	RES, COMP, 3K +/-5%, 1/4W	193508	01121	CB3025	3		
R5	RES, COMP, 3K +/-5%, 1/4W	193508	01121	CB3025	REF		
R6	RES, COMP, 3K +/-5%, 1/4W	193508	01121	CB3025	REF		
R7	RES, COMP, 1K +/-5%, 1/4W	148023	01121	CB1025	1		
R8	RES, COMP, 620 +/-5%, 1/4W	221903	01121	CB6215	1		
R9	RES, COMP, 2.2K +/-5%, 1/4W	148049	01121	CB2225	1		
R10	RES, COMP, 47 +/-5%, 1/4W	147892	01121	CB4705	1		
R11	RES, COMP, 750 +/-5%, 1/4W	218024	01121	CB7515	1		
S1	SWITCH, SLIDE	393629	10389	23-021-114	1		
U1	IC, XCVR/XMITTER, UNIV., ASYNCHRONOUS	354753	14936	AY-S-1013	1	1	
U2	IC, MOS, FIFO MEMORY	404095	34335	AM2812ADC	1	1	
U3	IC, TTL, HEX-INV	393058	01295	SN74LS04J	2	1	
U4	IC, QUAD, 2-INPT POS GATE	393066	01295	SN74LS08	1	1	
U5	IC, QUAD, 2-INPT POS OR GATE	393108	01295	SN74LS32	1	1	
U6	IC, TTL, DUAL 4 BIT BINARY CNTR	419069	01295	SN74393N	1	1	
U7	IC, TTL, DUAL 4 BIT CNTR	402552	01295	SN74390N	1	1	
U8	IC, DUAL D F/F	393124	01295	SN74LS74N	3	1	
U9	IC, DUAL D F/F	393124	01295	SN74LS74N	REF		
U10	IC, DUAL D F/F	393124	01295	SN74LS74N	REF		
U11	IC, TTL, MSI, DATA DELEC/MULT	393025	01295	SN74L157N	1	1	

Table 606-5. RS-232-C Interface PCB Assembly (cont)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U12	IC, LINE DCDR	407585	01295	SN74LS138N	1	1	
U13	IC, RCVR, DUAL COM LINE	354704	18324	8T16A	1	1	
U14	IC, TTL, MSI, DUAL LINE DRVR	354696	18324	N8T15A	1	1	
U15	IC, TTL, HEX-1NV	393058	01295	SN74LS04J	REF		
U16	IC, TTL, MSI, P/N GATE	393033	01295	SN74LS00N	1		
U17	IC, TRPL3-INPT POS/GATE	393082	01295	SN74LS11J	1	1	
XU1	SOCKET, 40 PIN	376244	91506	340-AG39D	1		
XU2	SOCKET, 28 PIN	419077	01295	C922800	1		
Y1	CRYSTAL, 1.228MHZ	352344	87516	SCC815A	1		

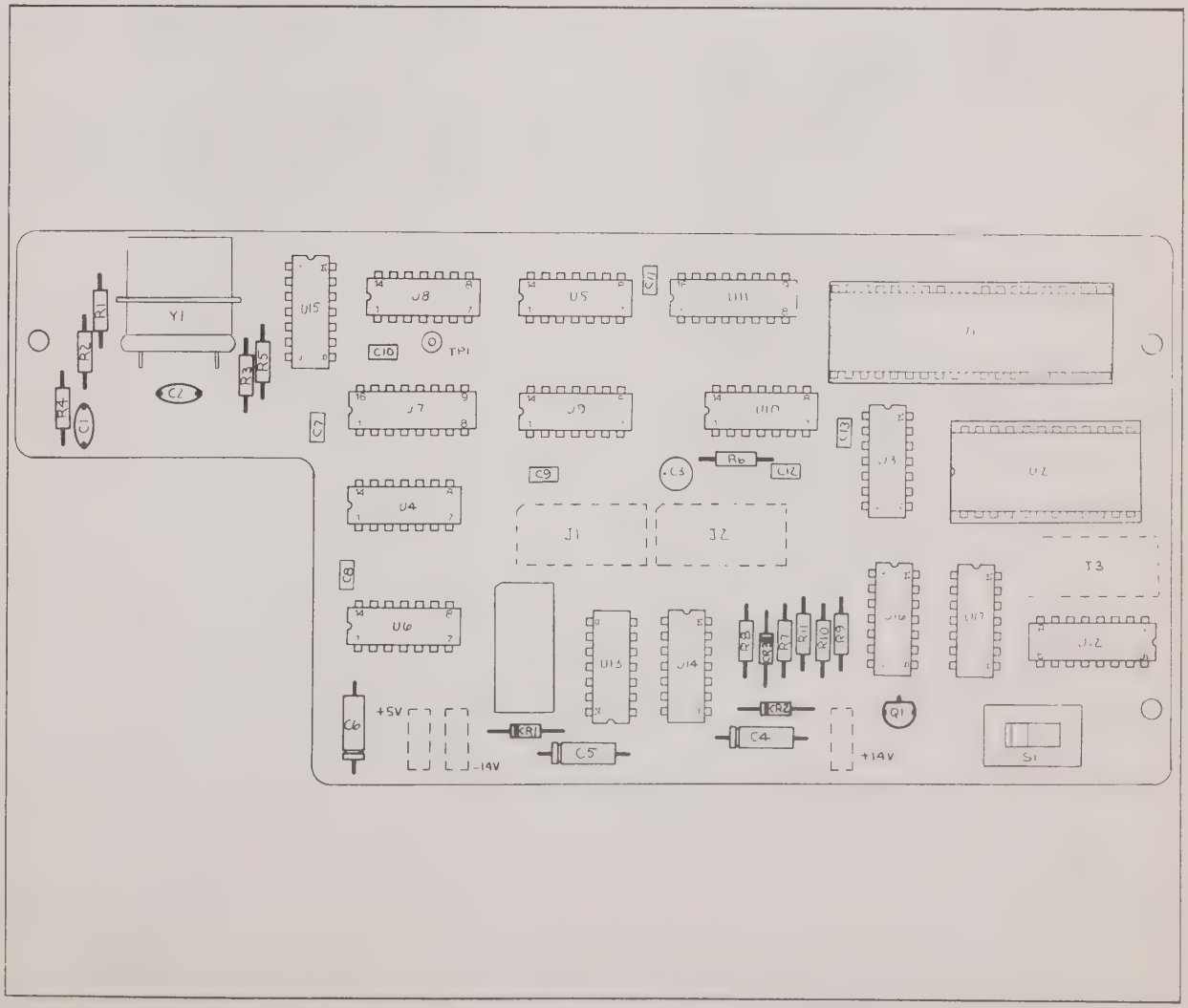

Figure 606-6. RS-232-C Interface Component Location

Option -07
50-400 Hz Line Power

607-1. INTRODUCTION

607-2. The -07 Option allows the 6011A to be operated from line power sources of 115 or 230V ac at 50 to 400 Hz. Operation of the 6011A equipped with the -07 Option is the same as a standard unit except for the frequency of the line power source. Refer to Section 2 for operation of the 6011A. The -07 option is factory installed.

607-3. OPERATION

607-4. Normal operation of the 6011A is not affected by the -07 Option.

Option -08
100V, 50-60 Hz Line Power

608-1. INTRODUCTION

608-2. The -08 Option provides for instrument operation from 100V ac 50 to 60 Hz power sources. Operation of the 6011A equipped with the -08 Option is the same as a standard unit except for the line power voltage level. Refer to Section 2 for operation of the 6011A. This is a factory installed option.

608-3. OPERATION

608-4. Normal operation of the 6011A is not affected by the -08 Option.

Option -09
20-31 MHz Tracking Output

609-1. INTRODUCTION

609-2. The -09 Option provides a 6011A rear panel output of a TTL level signal at a frequency of 20 to 31 MHz. The output has a 10 Hz resolution and will be equal in frequency to the 6011A output (in high range) plus 20 MHz; i.e., a 2.16837 MHz 6011A front panel output will result in a 22.16837 MHz tracking output signal. Normal operation of the 6011A is not affected by the -09 Option. If the -09 Option is to be installed simultaneously with the -04 Rear Output Option the -09 Option must be installed in the FM IN rear panel mounting hole. This option may be installed in the field. Order kit model number 6010/6011-09K.

609-3. OPERATION

609-4. Normal operation of the 6011A is not affected by the -09 Option.

Option -10
75Ω Output Impedance

610-1. INTRODUCTION

610-2. A Model 6011A equipped with the -10 Option has an output impedance of 75Ω instead of the standard 50Ω. This is accomplished by placing a 25Ω resistance in series with the instrument output on the Attenuator PCB. Frequency response is the only operating characteristic that changes when the -10 Option is installed. Figure 610-1 show the frequency response graphically. This is a factory installed option.

610-3. CALIBRATION

610-4. Calibration of the Model 6011A-10 is the same as that of the standard instrument excepting differences in output voltage. Table 610-1, Difference Voltages, lists these differences in output voltage.

610-5. LIST OF REPLACEABLE PARTS

610-6. Table 610-2, List of Replaceable Parts, describes the components added to the standard Model 6011A to provide the -10 Option.

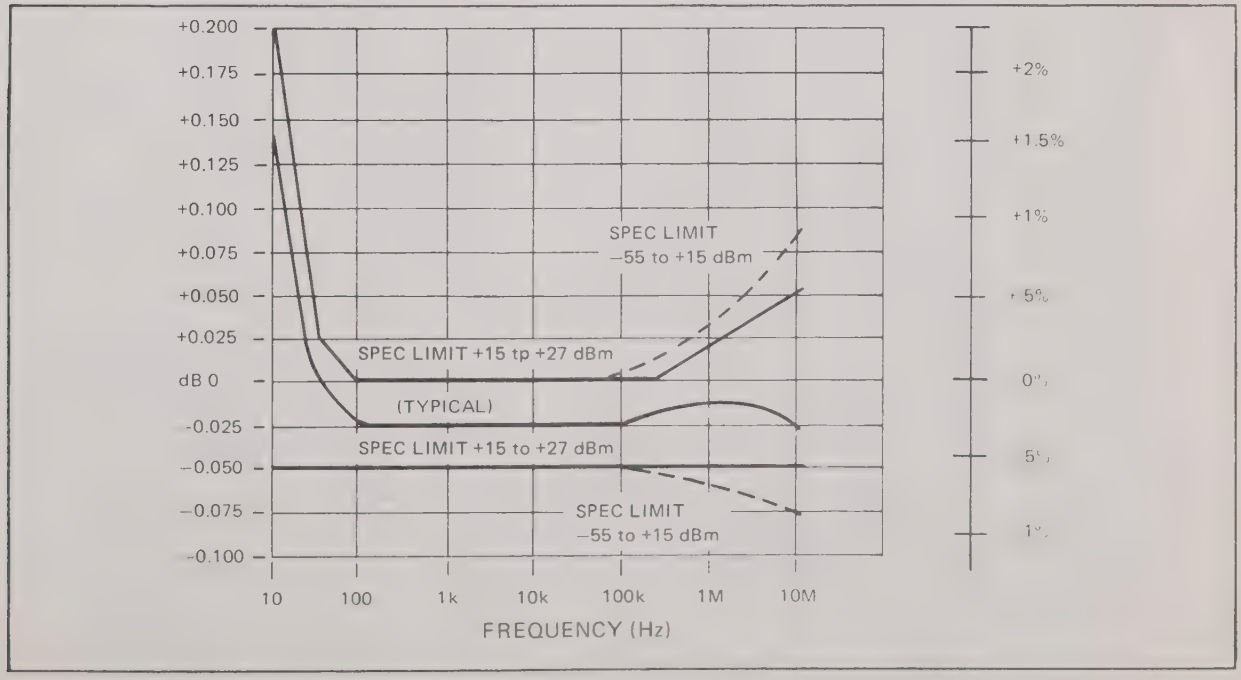

Figure 610-1. Model 6011A Frequency Response, Option -10 (75Ω)

Table 610-1. Difference Voltages

FREQUENCY	LOWER LIMIT (V)	UPPER LIMIT (V)
10 kHz	3.332	3.334
100 kHz - 5 MHz	3.326	3.340
6 MHz	3.325	3.341
7 MHz	3.324	3.342
8 MHz	3.323	3.343
9 MHz	3.322	3.344
10 MHz	3.322	3.344
10.99999 MHz	3.320	3.346

Table 610-2. 75Ω Output Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
MP1	NAMEPLATE, 75 OHM OUTPUT	437988	89536	437988	1		1
MP2	DECAL, 75 OHM OUTPUT	428912	89536	428912	1		2
R6	RES, MF, 14 +/-0.25%, 1/4W, T2	436162	91637	LMF1-4R140C	1		3
R7	RES, MF, 11 +/-0.25%, 1/4W, T2	436154	91637	LMF1-4R110C	1		3

1 LOCATED ON THE ATTENUATOR MODULE ASSY

2 LOCATED ON THE FRONT PANEL ASSY

3 LOCATED ON THE ATTENUATOR PCB ASSY

Appendix 7A
Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcn configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual with an X.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manual to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

Table 7A-1. Backdating

Ref Or Option No.	Assembly Name	Fluke Part No.	To adapt manual to earlier rev configurations perform changes in desending order (by no.), ending with change under desired rev letter																					
			A	B	C	D	E	F	G	H	J	K	L	M	N	P								
	FINAL ASSEMBLY	–	A																					
A1	FRONT PANEL ASSY	–	A																					
A1A1	DISPLAY PCB	412627										K												
A2	MAIN PCB	412619									J													
A3	INPUT/OUTPUT PCB	412635						F																
A4	SIX-DIGIT GENERATOR PCB	388058													N									
A5	ATTENUATOR PCB	412643						F																
A6	AMPLITUDE D/A PCB	412650			C																			
–02	PHASE LOCK INPUT	319011				D																		
–03	FM OSCILLATOR	391025		B																				
–05	IEEE-488 INTERFACE	409995					E																	
–06	RS-232-C INTERFACE	425215			C																			

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers — U.S. and Canada

Sales and Service Locations — International

Sales Representatives — U.S. and Canada

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
^{o}C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
^{o}F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^{9})
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^{3})
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^{6})
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(–) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers (Continued)

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

Federal Supply Codes for Manufacturers (Continued)

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onatrio, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14/52
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Stevens, Arnold Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81439
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

Fluke Technical Service Centers — U.S. and Canada

United States

CALIFORNIA
Burbank
Fluke Technical Center
2020 N. Lincoln St.
Zip: 91504
Tel. (213) 849-4641

Santa Clara
Fluke Technical Center
2300 Walsh Avenue
Zip: 95050
Tel. (408) 985-1200

COLORADO
Denver
Fluke Technical Center
1980 S. Quebec St.
Unit 4
Zip: 80231
Tel. (303) 750-1228

FLORIDA
Orlando
Fluke Technical Center
940 N. Fern Creek Ave.
Zip: 32803
Tel. (305) 896-2296

ILLINOIS
Rolling Meadows
Fluke Technical Center
1400 Hicks Road
Zip: 60008
Tel. (312) 398-5800

MARYLAND
Kensington
Fluke Technical Center
11501 Huff Court
Zip: 20795
Tel. (301) 881-6155

MASSACHUSETTS
Waltham
Fluke Technical Center
244 Second Ave.
Zip: 02154
Tel. (617) 890-1604

MINNESOTA
Minneapolis
Fluke Technical Center
10800 Lyndale Ave. So.
Zip: 55420
Tel. (612) 884-4541

NEW JERSEY
Clifton
Fluke Technical Center
460 Colfax Ave.
Zip: 07013
Tel. (201) 778-1339

NORTH CAROLINA
Greensboro
Fluke Technical Center
1310 Beaman Place
Zip: 27408
Tel. (919) 273-1918

TEXAS
Dallas
Fluke Technical Center
14400 Midway Road
Zip: 75240
Tel. (214) 233-9945

WASHINGTON
Mountlake Terrace
John Fluke Mfg. Co., Inc.
21707 66th Ave. W. Suite 1
Zip: 98043
Tel. (206) 774-2206

Canada

ALBERTA
Calgary
Allan Crawford Assoc. Ltd.
Fluke Technical Center
14-2280 39th N.E.
Zip: T2E 6P7
Tel. (403) 276-9658

ONTARIO
Mississauga
Allan Crawford Assoc. Ltd.
Fluke Technical Center
6503 Northam Drive
Zip: L4V 1J5
Tel. (416) 678-1500

QUEBEC
Longueuil
Allan Crawford Assoc. Ltd.
Fluke Technical Center
1330 Marie Victorin Blvd. E.
Zip: J4G 1A2
Tel. (514) 670-1212

Sales and Service Locations — International

Supplied and supported by Fluke (Nederland) B.V., P.O. Box 5053, Zevenheuvelenweg 53, Tilburg, Netherlands.

EUROPE

AUSTRIA
*Walter Rekirsch Elektronische
Gerate GmbH & Co. Vertrieb KG
Liechtensteinstrasse 97/6
A-1090 Vienna, Austria
Tel. (222) 347646-0

BELGIUM
*C. N. Rood S/A
37 Place de Jamblinne de Meux
B-1040 Brussels, Belgium
Tel. (02) 27352135

CYPRUS
Chris Radiovision Ltd.
P.O. Box 1989
Nicosia, Cyprus
Tel. 66121

DENMARK
*Tage Olsen A/S
Ballerup Byveg 222
DK-2750 Ballerup
Tel. (01) 2-65 81 11

FINLAND
*Oy Findip AB
Teollisuustie 7
02700 Kauniainen
Helsinki, Finland
Tel. (080) 502255

FRANCE
*M. B. Electronique S.A.
Rue Fourney
ZAC de BUC
B. P. No. 31
78530 BUC, France
Tel. (01) 9563130

GERMAN FEDERAL REPUBLIC
*Fluke (Deutschland) GmbH
4-Dusseldorf
Meineckestrasse 53
West Germany
Tel. 211-450831

*Fluke (Deutschland) GmbH
8000 Munich 80
Vertriesburo Bayern
Rosenheimer Strasse 139
West Germany
Tel. 089-404061

GREECE
*Hellenic Scientific
Representations Ltd.
11 Vrassida Street
Athens 612, Greece
Tel. (021) 7792320

ITALY
*Sistrel S.p.A.
Via Giuseppe Armellini No. 39
00143 Rome, Italy
Tel. (06) 5915551

*Sistrel S.p.A.
Via Timavo 66
20099 Sesto S. Giovanni (Milan)
Italy
Tel. (02) 2476693

NETHERLANDS
*C.N. Rood, B.V.
Cort van der Lindenstraat 11-13
Rijswijk ZH2280AA
Netherlands
Tel. (070) 996360

NORWAY
*Morgenstierne & Co. A/A
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel. (02) 356110

PORTUGAL
*Equipamentos
De Laboratorio Ltda.
P.O. Box 1100
Lisbon 1, Portugal
Tel. (019) 976551

SPAIN
*Hispano Electronica S.A.
Poligono Industrial Urtinsa
Apartado de Correos 48
Alcorcon (Madrid), Spain
Tel. 09-341-6194108

SWEDEN
*Teleinstrument AB
P.O. Box 490
S-162 Vallingby-4
Sweden
Tel. (08) 380370

SWITZERLAND
*Traco Electronic AG
Jenatschstrasse 1
8002 Zurich, Switzerland
Tel. (01) 2010711

TURKEY
*Erkman Electronik Aletler
Necatibey Cad 92/2
Karakoy/Istanbul
Turkey
Tel. 441546

UNITED KINGDOM
*Fluke International Corp.
Colonial Way
Watford Herts WD2 4TT, England
Tel. (0923) 40511

MIDDLE EAST

EGYPT
Lotus Engineering Organisation
P.O. Box 1252
Cairo, Egypt
Tel. 71617

IRAN
*Irantronics Company Ltd.
20 Salm Road, Roosevelt Ave.
Tehran, Iran
Tel. 828294

ISRAEL
*R.D.T. Electronics
Engineering Ltd.
46, Sokolov Street
Ramat Hasharon 47235, Israel
Tel. 482311

JORDAN
Trading & Agricultural
Development Co.
P.O. Box 567
Amman, Jordan
Tel. 23052

KUWAIT
Tareq Company
P.O. Box Safat 20506
Kuwait, Arabian Gulf
Tel. 436100

LEBANON
Mabek
P.O. Box 11-3823
Beirut, Lebanon
Tel. 252631

MOROCCO
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Section 8
Schematic Diagrams

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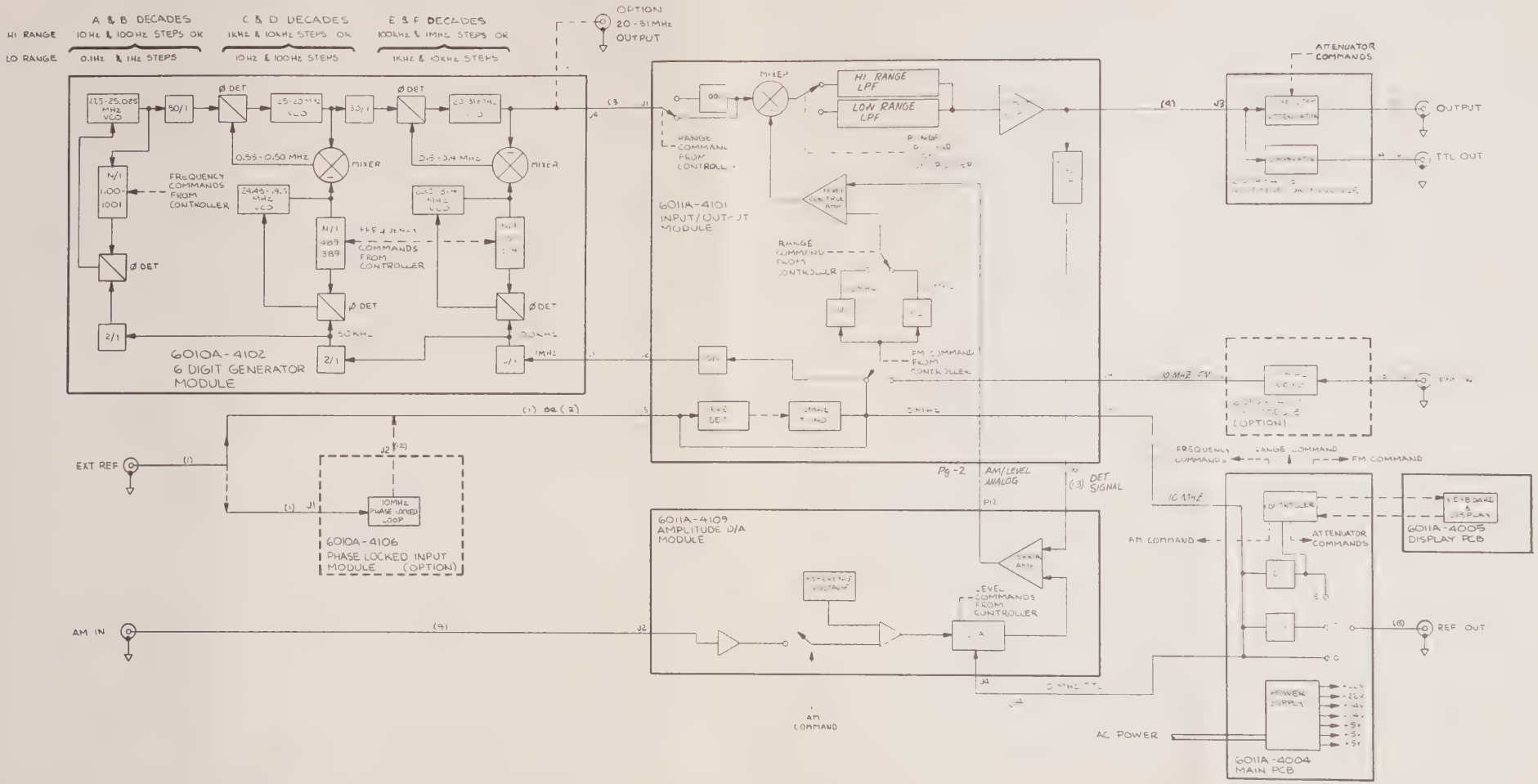
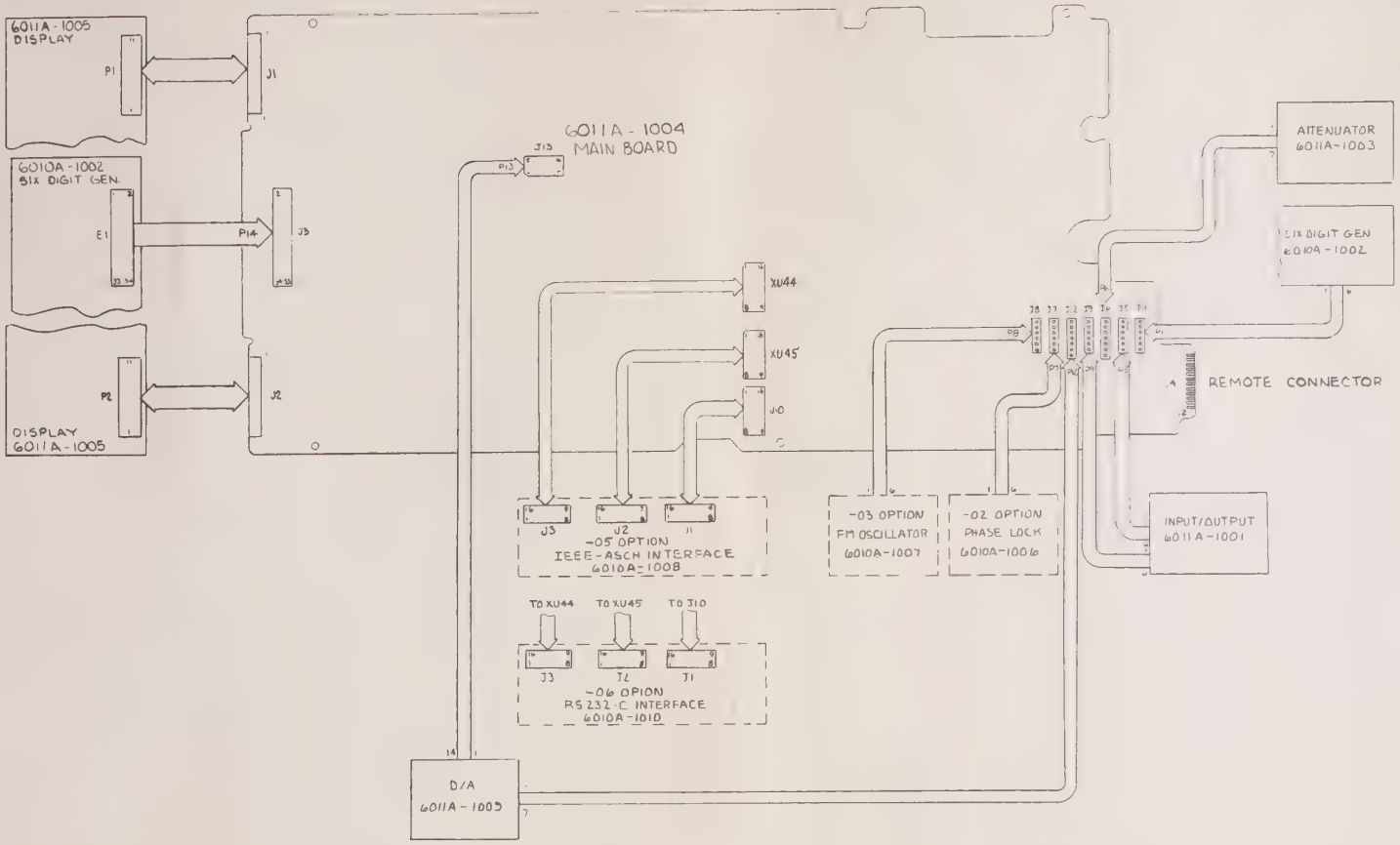
ADB1 thru ADB8	ASCII Data Bits
$\overline{AD0}$ thru $\overline{AD3}$	Annunciator Data
$\overline{BLANK\ LEVEL}$	Level Display Blanking
$\overline{BLANK\ FREQ}$	Frequency Display Blanking
BSY	Processor Busy
DAS	D/A Settling
$\overline{DEC0}$ thru $\overline{DEC2}$	Decade Edit Control
$\overline{DIG0}$ thru $\overline{DIG2}$	Digit Edit Control
DO1, DO2, DO4, DO8	Level Commands
DRY	Data Ready
DT0 thru DT9	Display Strobes
FD1, FD2, FD3, FD4	Frequency Display Data
$\overline{FREQ.\ DP}$	Frequency Display Decimal Point
KD0 thru KD3	Keyboard Data
LD1, LD2, LD4, LD8	Level Display Data
$\overline{LEVEL\ DP}$	Level Display Decimal Point
PRD	Processor Done
REM	Remote Enable
ROL	Reduce Output Level

Figure 8-1. Mnemonics



6011A-1501

Figure 8-2. System Block Diagram



6011A-1502
(Sheet 1 of 3)

Figure 8-3. Interconnect Diagram

FUCTION TABLE

CONNECTOR	PIN NO.	FUNCTION
6011A-1005-P1	1	$\overline{DT5}$
	2	$\overline{DT6}$
	3	$\overline{DT3}$
	4	$\overline{DEC2}$
	5	$\overline{DEC0}$
	6	$\overline{DIG1}$
	7	$\overline{FREQ\ D\ P}$
	8	GND
	9	+5V(1)
	10	FD2
	11	$\overline{FD8}$
	12	$\overline{DT2}$
	13	$\overline{DT7}$
	14	$\overline{DT1}$
	15	$\overline{DT4}$
	16	$\overline{DEC1}$
	17	$\overline{DIG2}$
	18	$\overline{DIG0}$
	19	$\overline{BLANK\ FREQ}$
	20	+5V(1)
	21	FD4
	22	FD1
6011A-1005-P2	1	LD1 } LEVEL
	2	LD2 } DISPLAY
	3	LD4 } DATA
	4	LD8 }
	5	$\overline{ROL}$
	6	$\overline{DT8}$
	7	*
	8	$\overline{REM}$
	9	$\overline{KD3}$
	10	$\overline{FM\ CONTROL}$
	11	$\overline{KD2}$
	12	$\overline{BLANK\ LEVEL}$
	13	+5V(1)
	14	$\overline{LEVEL\ D\ P}$
	15	SPARE
	16	$\overline{GND}$
	17	$\overline{AD3}$
	18	$\overline{AD0}$
	19	$\overline{AD2}$
	20	$\overline{AD1}$
	21	$\overline{KD1}$
	22	$\overline{KD0}$
6010-1002-P14 (E1)	1	OVERRANGE } Not Used on 6011A
	2	OVERRANGE }
	3	*
	4	*
	5	'4'b DECADE CONTROL INPUT
	6	'1'b DECADE CONTROL INPUT
	7	*
	8	'8'f DECADE CONTROL INPUT
	9	'2'b DECADE CONTROL INPUT
	10	'8'b DECADE CONTROL INPUT
	11	'4'a DECADE CONTROL INPUT
	12	f DECADE OVERRANGE '1'
	13	'1'a DECADE CONTROL INPUT

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION
6010-1002-P14 (E1) (cont)	14	'2'a DECADE CONTROL INPUT
	15	GND
	16	'8'a DECADE CONTROL INPUT
	17	'1'd DECADE CONTROL INPUT
	18	GND
	19	GND
	20	'4'd DECADE CONTROL INPUT
	21	'1'e DECADE CONTROL INPUT
	22	'8'e DECADE CONTROL INPUT
	23	'8'd DECADE CONTROL INPUT
	24	'2'd DECADE CONTROL INPUT
	25	'4'e DECADE CONTROL INPUT
	26	'2'e DECADE CONTROL INPUT
	27	'4'c DECADE CONTROL INPUT
	28	'1'c DECADE CONTROL INPUT
	29	'8'c DECADE CONTROL INPUT
	30	'2'c DECADE CONTROL INPUT
	31	'4'f DECADE CONTROL INPUT
	32	'2'f DECADE CONTROL INPUT
	33	'1'f DECADE CONTROL INPUT
	34	'8'f DECADE CONTROL INPUT
6010A-1002-P11	1	+14V (BRN)
	2	KEY
	3	−14V (RED)
	4	+5V(3) (ORN)
	5	*
	6	*
6011A-1001-P9	1	ANALOG GND (BRN)
	2	AM/LEVEL ANALOG (RED)
	3	ANALOG GND (ORN)
	4	RANGE CONTROL (YEL)
	5	$\overline{KEY}$
	6	$\overline{FM\ CONTROL}$ (GRN)
6011A-1001-P5	1	−14V (BRN)
	2	+14V (RED)
	3	KEY
	4	+22V (ORN)
	5	−22V (YEL)
	6	+5V(2) (GRN)
6010A-1006-P7	1	+14V (BRN)
	2	KEY
	3	−14V (RED)
	4	+5V(2) (ORN)
	5	*
	6	*
6011A-1003-P6	1	$\overline{KEY}$
	2	$\overline{10\ dB}$ (BRN)
	3	14V (RED)
	4	+22V (ORN)
	5	+5V(2) (YEL)
	6	$\overline{20\ dB}$ (GRN)
	7	$\overline{40\ dB}$ (BLU)

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION
6010A-1007-P8	1	+14V (BRN)
	2	−14V (RED)
	3	+5V(2) (ORN)
	4	$\overline{FM}$ (YEL)
	5	$\overline{FM CONTROL}$ (GRN)
	6	KEY
6010A-1008-J1 (-05 OPTION)	1	+5V(1)
	2	+5V(1)
	3	+5V(1)
	4	F/FF 1
	5	CLK
	6	*
	7	*
	8	*
	9	GND (8)
	10	GND (11)
	11	GND (10)
	12	GND (9)
	13	GND (7)
	14	GND (6)
	15	*
	16	$\overline{REN}$
6010-1008-J2 (-05 OPTION)	1	DRY
	2	BSY
	3	*
	4	$\overline{REM}$
	5	*
	6	*
	7	+5V
	8	*
	9	*
	10	$\overline{EOI}$
	11	$\overline{ATN}$
	12	$\overline{SRQ}$
	13	$\overline{IFC}$
	14	DAC
	15	RFD
	16	$\overline{DAV}$
6010A-1008-J3 (-05 OPTION)	1	ADB1
	2	ADB2
	3	ADB3
	4	ADB4
	5	ADB5
	6	ADB6
	7	ADB7
	8	$\overline{ADB8}$
	9	$\overline{DIO8}$
	10	$\overline{DIO7}$
	11	$\overline{DIO6}$
	12	$\overline{DIO5}$
	13	$\overline{DIO4}$
	14	$\overline{DIO3}$
	15	$\overline{DIO2}$
	16	$\overline{DIO1}$

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION
6011A-1004-J1	1	$\overline{DT5}$
	2	$\overline{DT6}$
	3	$\overline{DT3}$
	4	$\overline{DEC2}$
	5	$\overline{DEC0}$
	6	$\overline{DIG1}$
	7	$\overline{FREQ\ D.P}$
	8	GND
	9	+5V(1)
	10	FD2
	11	$\overline{FD8}$
	12	$\overline{DT2}$
	13	$\overline{DT7}$
	14	$\overline{DT1}$
	15	$\overline{DT4}$
	16	$\overline{DEC1}$
	17	$\overline{DIG2}$
	18	$\overline{DIG0}$
	19	$\overline{BLANK\ FREQ}$
	20	+5V(1)
	21	FD4
	22	FD1
6011A-1004-J2	1	LD1 } LEVEL
	2	LD2 } DISPLAY
	3	LD4 } DATA
	4	LD8 }
	5	$\overline{ROL}$
	6	$\overline{DT8}$
	7	*
	8	$\overline{REM}$
	9	$\overline{KD3}$
	10	$\overline{FM\ CONTROL}$
	11	$\overline{KD2}$
	12	$\overline{BLANK\ LEVEL}$
	13	+5V(1)
	14	$\overline{LEVEL\ D.P}$
	15	SPARE
	16	$\overline{GND}$
	17	$\overline{AD3}$
	18	$\overline{AD0}$
	19	$\overline{AD2}$
	20	$\overline{AD1}$
	21	$\overline{KD1}$
	22	$\overline{KD0}$
6011A-1004-J3	1	OVERRANGE } Not Used on 6011A
	2	OVERRANGE }
	3	*
	4	*
	5	'4'b DECADE CONTROL
	6	'1'b DECADE CONTROL
	7	*
	8	'8'f DECADE CONTROL
	9	'2'b DECADE CONTROL
	10	'8'b DECADE CONTROL
	11	'4'a DECADE CONTROL
	12	f DECADE OVERRANGE '1'
	13	'1'a DECADE CONTROL
	14	'2'a DECADE CONTROL
	15	GND

NOTES:

1 ▷ Fixed/Free Format

* No Connection

6011A-1502
(Sheet 2 of 3)

Figure 8-3. Interconnect Diagram (cont)

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION		
6011A-1004-J3 (cont)	16	'8'a DECADE CONTROL		
	17	'1'd DECADE CONTROL		
	18	GND		
	19	GND		
	20	'4'd DECADE CONTROL		
	21	'1'e DECADE CONTROL		
	22	'8'e DECADE CONTROL		
	23	'8'd DECADE CONTROL		
	24	'2'd DECADE CONTROL		
	25	'4'e DECADE CONTROL		
	26	'2'e DECADE CONTROL		
	27	'4'c DECADE CONTROL		
	28	'1'c DECADE CONTROL		
	29	'8'c DECADE CONTROL		
	30	'2'c DECADE CONTROL		
	31	'4'f DECADE CONTROL		
	32	'2'f DECADE CONTROL		
	33	'1'f DECADE CONTROL		
	34	'8'f DECADE CONTROL		
		STD REMOTE	-05 OPTION	-06 OPTION
6011A-1004-J4 (REMOTE CONN)	1	ADB1	$\overline{DIO1}$	*
	2	ADB2	$\overline{DIO2}$	*
	3	ADB3	$\overline{DIO3}$	*
	4	ADB4	$\overline{DIO4}$	*
	5	+5V(1)	$\overline{EOI}$	GND
	6	DRY	$\overline{DAV}$	SDI
	7	$\overline{BSY}$	RFD	SDO
	8	$\overline{PRD}$	DAC	*
	9	$\overline{REM}$	$\overline{IFC}$	$\overline{REM}$
	10	SPARE	$\overline{SRQ}$	*
	11	ROL	$\overline{ATN}$	GND
	12	SPARE	SHIELD	*
	13	ADB5	$\overline{DIO5}$	*
	14	ADB6	$\overline{DIO6}$	*
	15	ADB7	$\overline{DIO7}$	*
	16	ADB8	$\overline{DIO8}$	*
	17	SPARE	$\overline{REN}$	*
	18	SPARE	GND (6)	*
	19	F/FF ◁ 1	GND (7)	FF/F ◁ 1
	20	DAS	GND (8)	*
	21	SPARE	GND (9)	*
	22	SPARE	GND (10)	*
	23	SPARE	GND (11)	*
	24	GND	*	*
6011A-1004-J5	1	−14V		
	2	+14V		
	3	KEY		
	4	+22V		
	5	−22V		
	6	+5V(2)		
6011A-1004-J6	1	KEY		
	2	$\overline{10\ dB}$		
	3	−14V		
	4	+22V		
	5	+5V(2)		
	6	$\overline{20\ dB}$		
	7	$\overline{40\ dB}$		

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION		
6011A-1004-J7	1	+14V		
	2	KEY		
	3	−14V		
	4	+5V(2)		
	5	*		
	6	*		
6011A-1004-J8	1	+14V		
	2	−14V		
	3	+5V(2)		
	4	$\overline{FM}$		
	5	$\overline{FM\ CONTROL}$		
	6	KEY		
6011-1004-J9	1	ANALOG GND		
	2	AM/LEVEL ANALOG		
	3	ANALOG GND		
	4	RANGE CONTROL		
	5	KEY		
	6	FM CONTROL		
		STANDARD	-05 OPTION	-06 OPTION
6011A-1004-J10	1	+5V(1)	+5V(1)	+5V(1)
	2	+5V(1)	+5V(1)	+5V(1)
	3	+5V(1)	+5V(1)	+5V(1)
	4	F/FF ◁ 1	F/FF ◁ 1	F/FF ◁ 1
	5	1 MHz	CLK	*
	6	DO1	*	DO1
	7	DO8	*	DO8
	8	DAS	*	DAS
	9	DAS	GND (8)	*
	10	SPARE	GND (11)	*
	11	SPARE	GND (10)	*
	12	SPARE	GND (9)	*
	13	F/FF ◁ 1	GND (7)	F/FF ◁ 1
	14	SPARE	GND (6)	*
	15	SPARE	*	*
	16	SPARE	$\overline{REN}$	*
		STANDARD	-05 OPTION	-06 OPTION
6011A-1004-XU44	1	ADB1	ADB1	ADB1
	2	ADB2	ADB2	ADB2
	3	ADB3	ADB3	ADB3
	4	ADB4	ADB4	ADB4
	5	ADB5	ADB5	ADB5
	6	ADB6	ADB6	ADB6
	7	ADB7	ADB7	ADB7
	8	ADB8	ADB8	ADB8
	9	ADB8	$\overline{DIO8}$	*
	10	ADB7	$\overline{DIO7}$	*
	11	ADB6	$\overline{DIO6}$	*
	12	ADB5	$\overline{DIO5}$	*
	13	ADB4	$\overline{DIO4}$	*
	14	ADB3	$\overline{DIO3}$	*
	15	ADB2	$\overline{DIO2}$	*
	16	ADB1	$\overline{DIO1}$	*

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION		
		STANDARD	-05 OPTION	-06 OPTION
6011A-1004-XU45	1	DRY	DRY	DRY
	2	$\overline{BSY}$	BSY	$\overline{BSY}$
	3	$\overline{PRD}$	*	$\overline{PRD}$
	4	$\overline{REM}$	$\overline{REM}$	$\overline{REM}$
	5	SPARE	*	*
	6	ROL	*	ROL
	7	+5V(1)	+5V(1)	+5V(1)
	8	GND	*	*
	9	GND	*	*
	10	+5V(1)	$\overline{EOI}$	GND
	11	ROL	$\overline{ATN}$	GND
	12	SPARE	$\overline{SRQ}$	*
	13	$\overline{REM}$	$\overline{IFC}$	$\overline{REM}$
	14	$\overline{PRD}$	DAC	*
	15	BSY	RFD	SDO
	16	DRY	$\overline{DAV}$	SDI
6011A-1004-J11	1	+14V		
	2	KEY		
	3	14V		
	4	+5V(3)		
	5	*		
	6	*		
6011A-1004-J12	1	+5V(2)		
	2	KEY		
	3	−14V		
	4	+14V		
	5	ANALOG GND		
	6	AM/LEVEL ANALOG		
	7	ANALOG GND		
6011A-1004-J13	1	$\overline{DT1}$		
	2	$\overline{DT2}$		
	3	$\overline{DT3}$		
	4	$\overline{DT4}$		
	5	$\overline{DT5}$		
	6	DO1		
	7	GND		
	8	DO2		
	9	DO4		
	10	$\overline{DO8}$		
	11	$\overline{DA/CK}$		
	12	ROL		
	13	AM		
	14	DAS		
6011A-1009-P12	1	+5V(2)		
	2	KEY		
	3	−14V		
	4	+14V		
	5	ANALOG GND		
	6	AM/LEVEL ANALOG		
	7	ANALOG GND		

FUNCTION TABLE

CONNECTOR	PIN NO.	FUNCTION
6011A-1009-P13	1	$\overline{DT1}$
	2	$\overline{DT2}$
	3	$\overline{DT3}$
	4	$\overline{DT4}$
	5	$\overline{DT5}$
	6	DO1
	7	GND
	8	DO2
	9	DO4
	10	$\overline{DO8}$
	11	$\overline{DA/CK}$
	12	ROL
	13	AM
	14	DAS
6010A-1010-J1 (-06 OPTION)	1	+5V(1)
	2	+5V(1)
	3	+5V(1)
	4	F/FF ◁ 1
	5	*
	6	DO1
	7	DO8
	8	DAS
	9	*
	10	*
	11	*
	12	*
	13	F/FF ◁ 1
	14	*
	15	*
	16	*
6010A-1010-J2 (-06 OPTION)	1	DRY
	2	$\overline{BSY}$
	3	$\overline{PRD}$
	4	$\overline{REM}$
	5	*
	6	ROL
	7	+5V(1)
	8	*
	9	*
	10	GND
	11	GND
	12	*
	13	$\overline{REM}$
	14	*
	15	SD0
	16	SD1
6010A-1010-J3	1	ADB1
	2	ADB2
	3	ADB3
	4	ADB4
	5	ADB5
	6	ADB6
	7	ADB7
	8	ADB8
	9	*
	10	*
	11	*
	12	*
	13	*
	14	*
	15	*
	16	*

1 ◁ Fixed/Free Format
* No Connection

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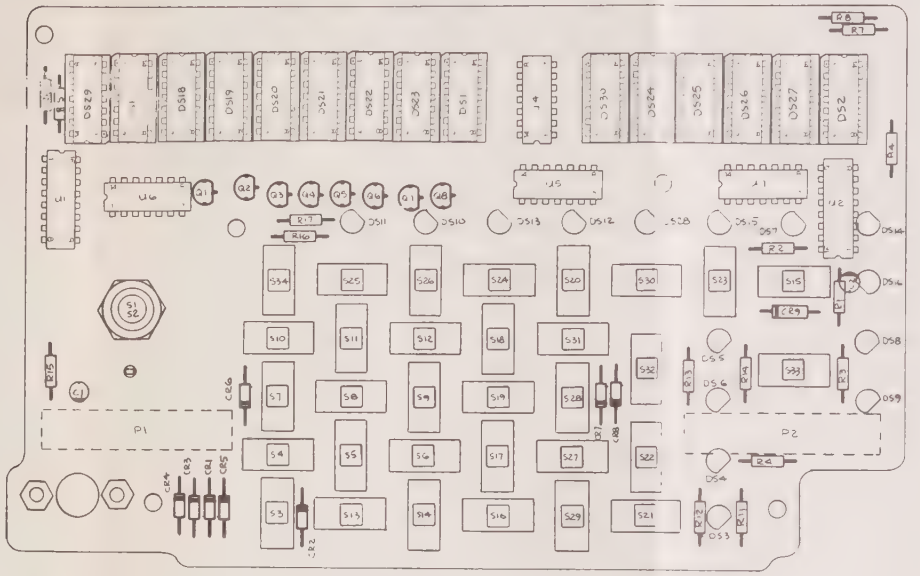
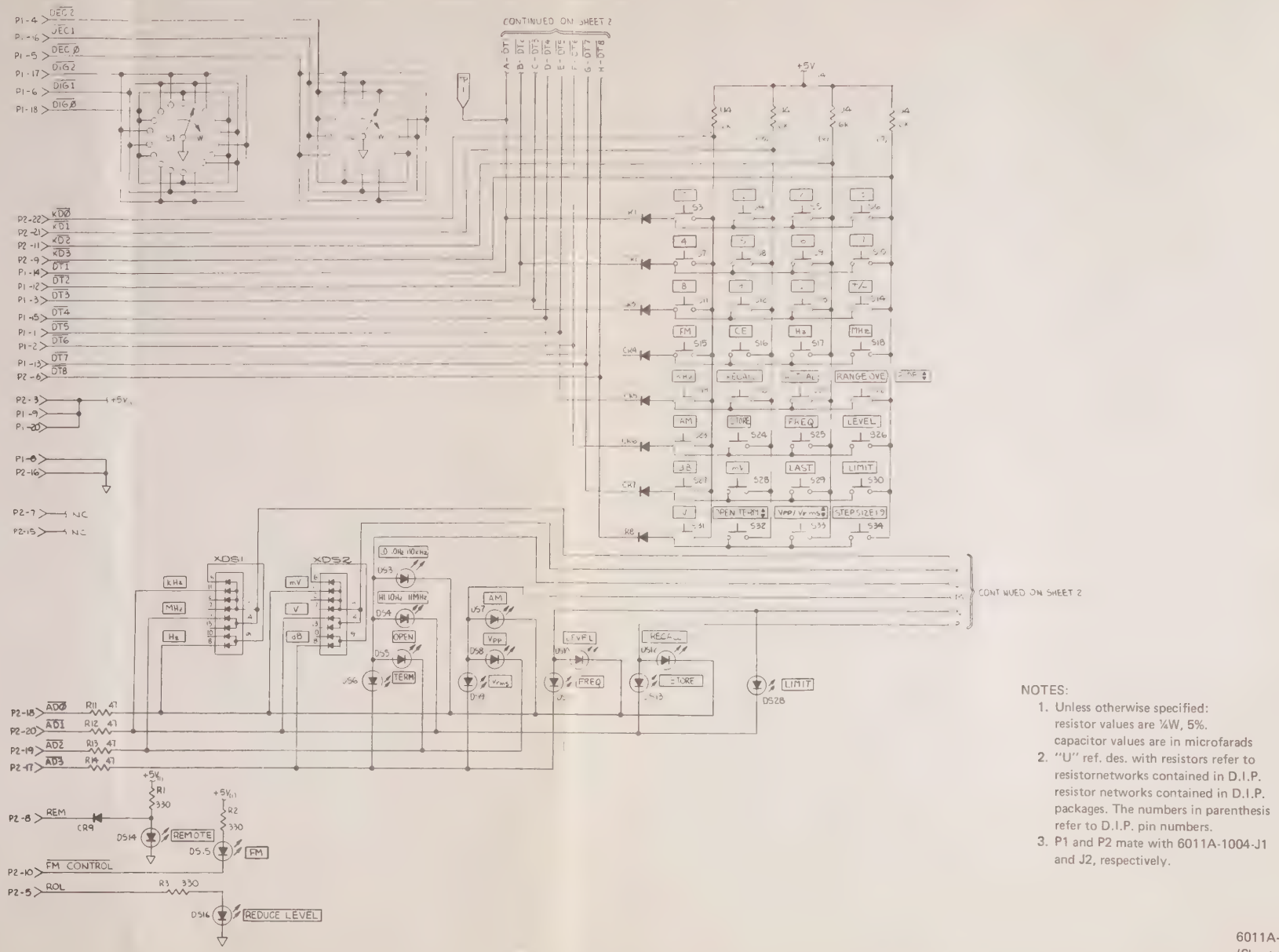
(Sheet 3 of 3)

Figure 8-3. Interconnect Diagram (cont)



6011A-1605

Figure 8-4. A1A1 Front Panel Display PCB Assembly



NOTES:

1. Unless otherwise specified: resistor values are ¼W, 5%. capacitor values are in microfarads
2. "U" ref. des. with resistors refer to resistornetworks contained in D.I.P. resistor networks contained in D.I.P. packages. The numbers in parenthesis refer to D.I.P. pin numbers.
3. P1 and P2 mate with 6011A-1004-J1 and J2, respectively.

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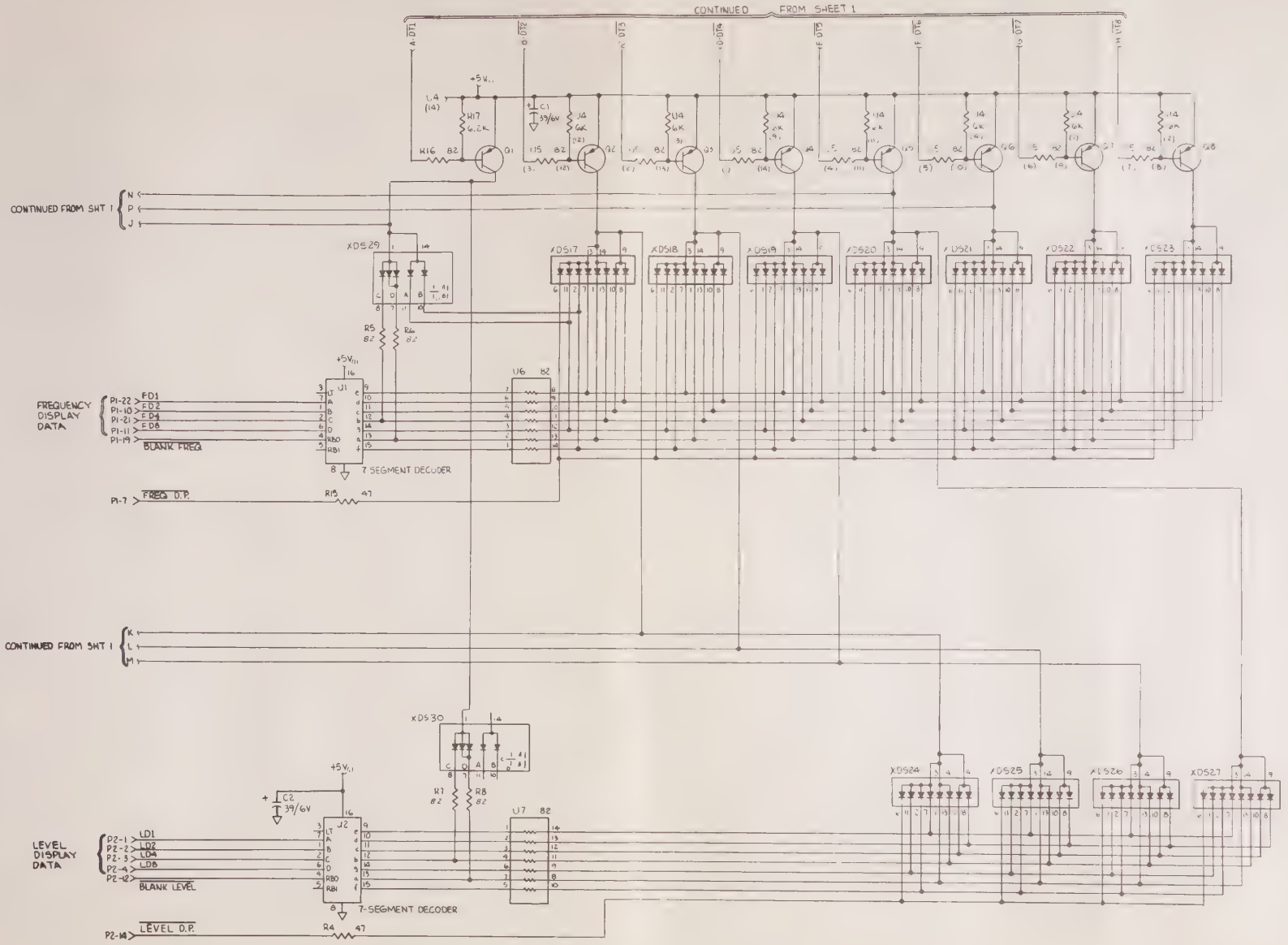
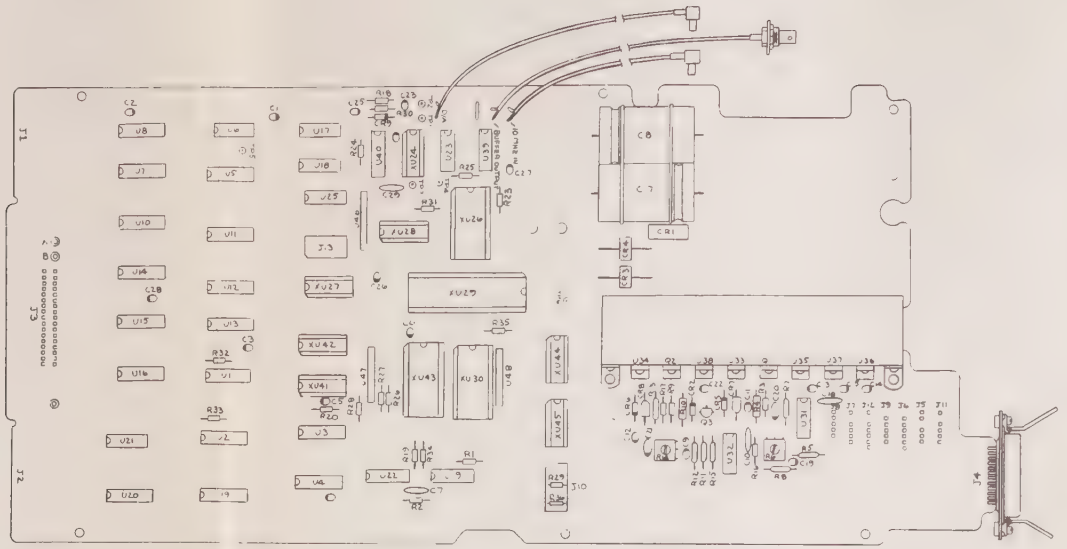
(Sheet 1 of 2)

Figure 8-4. A1A1 Front Panel Display PCB Assembly (cont)



6011A-1005
(Sheet 2 of 2)

Figure 8-4. A1A1 Front Panel Display PCB Assembly (cont)



6011A-1604

Figure 8-5. A2 Main PCB Assembly

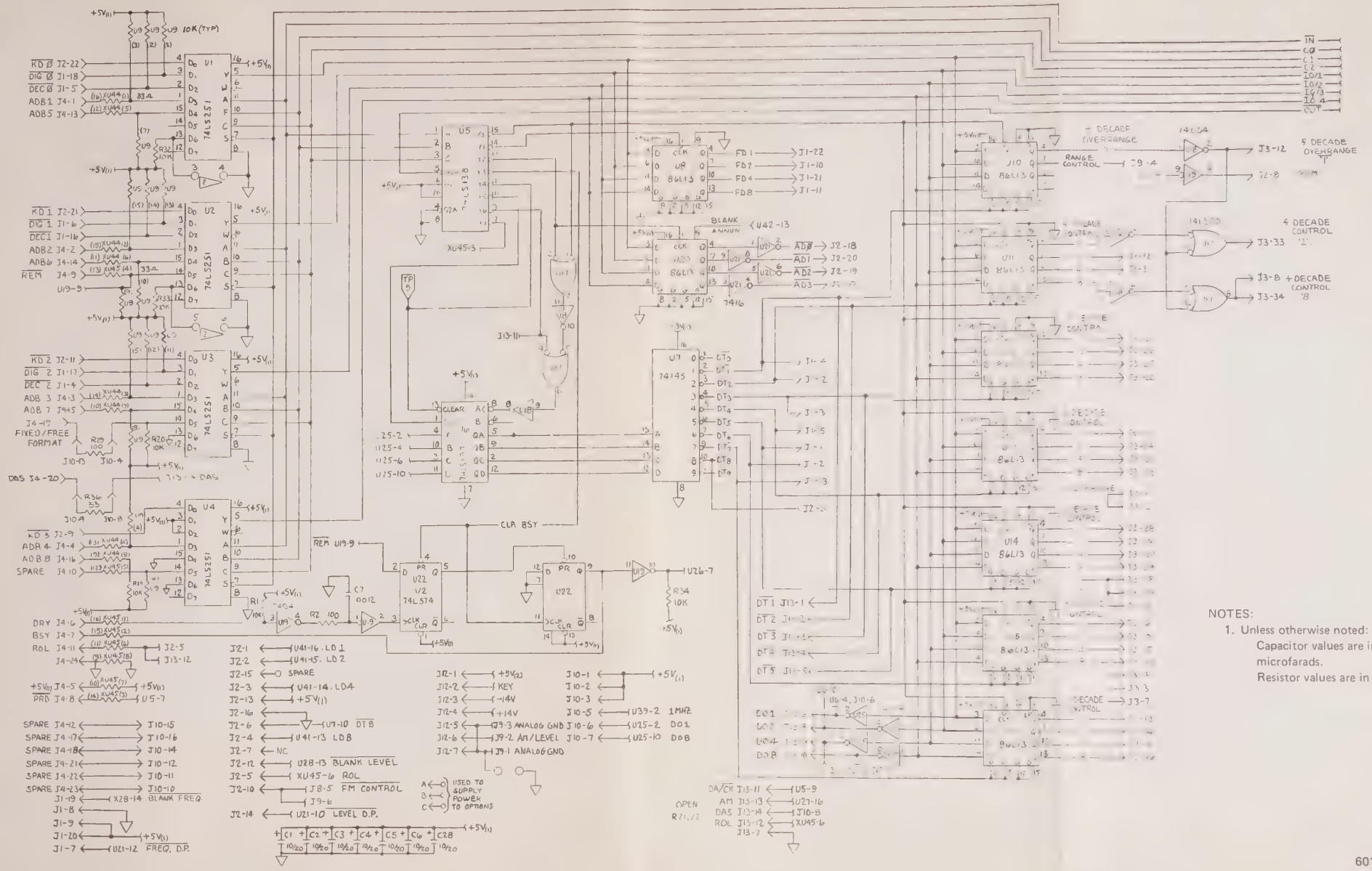


Figure 8-5. A2 Main PCB Assembly (cont)

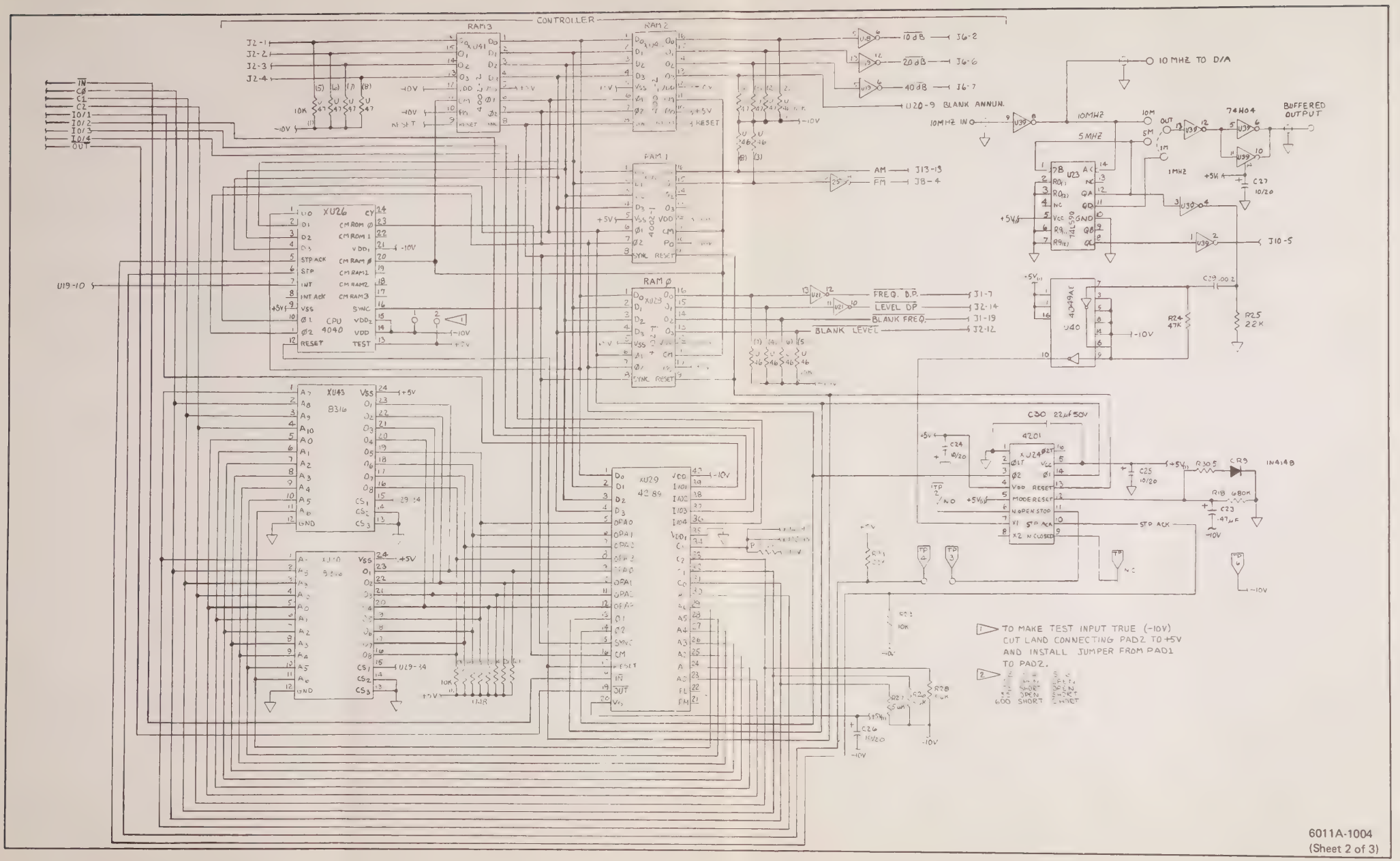
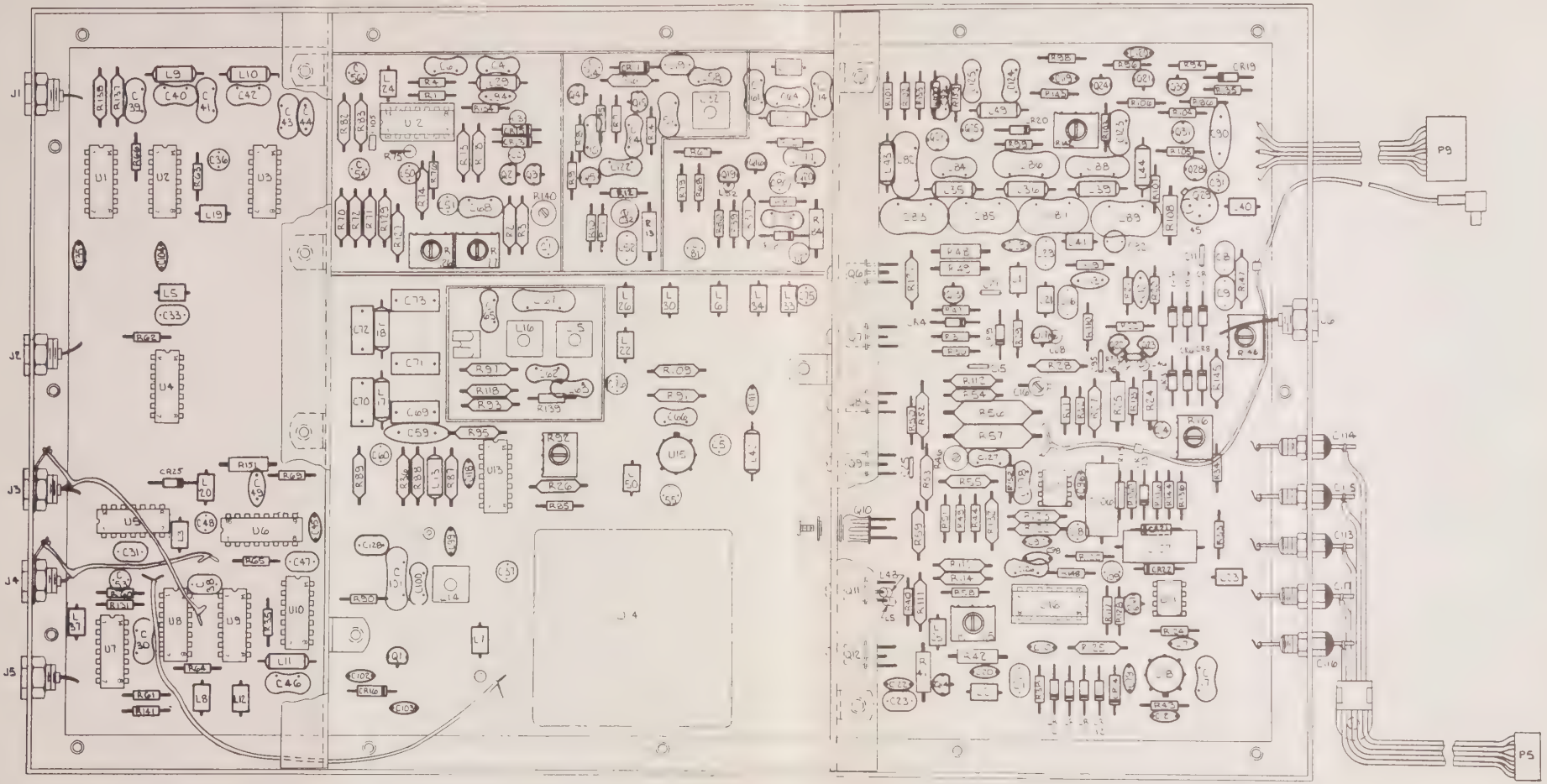


Figure 8-5. A2 Main PCB Assembly (cont)



6011A-1601

Figure 8-6. A3 Input/Output PCB Assembly

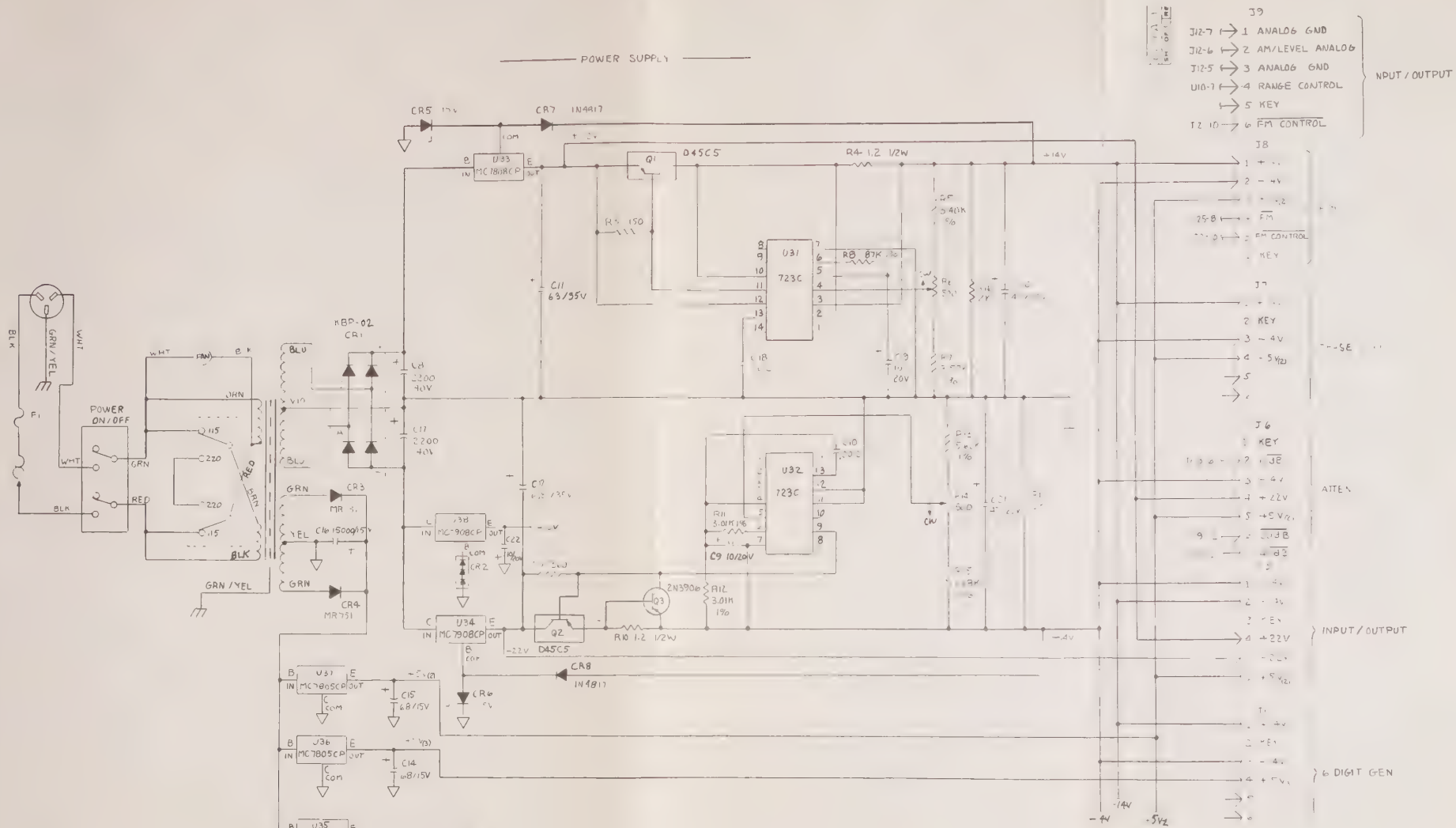


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Figure 8-5. A2 Main PCB Assembly (cont)

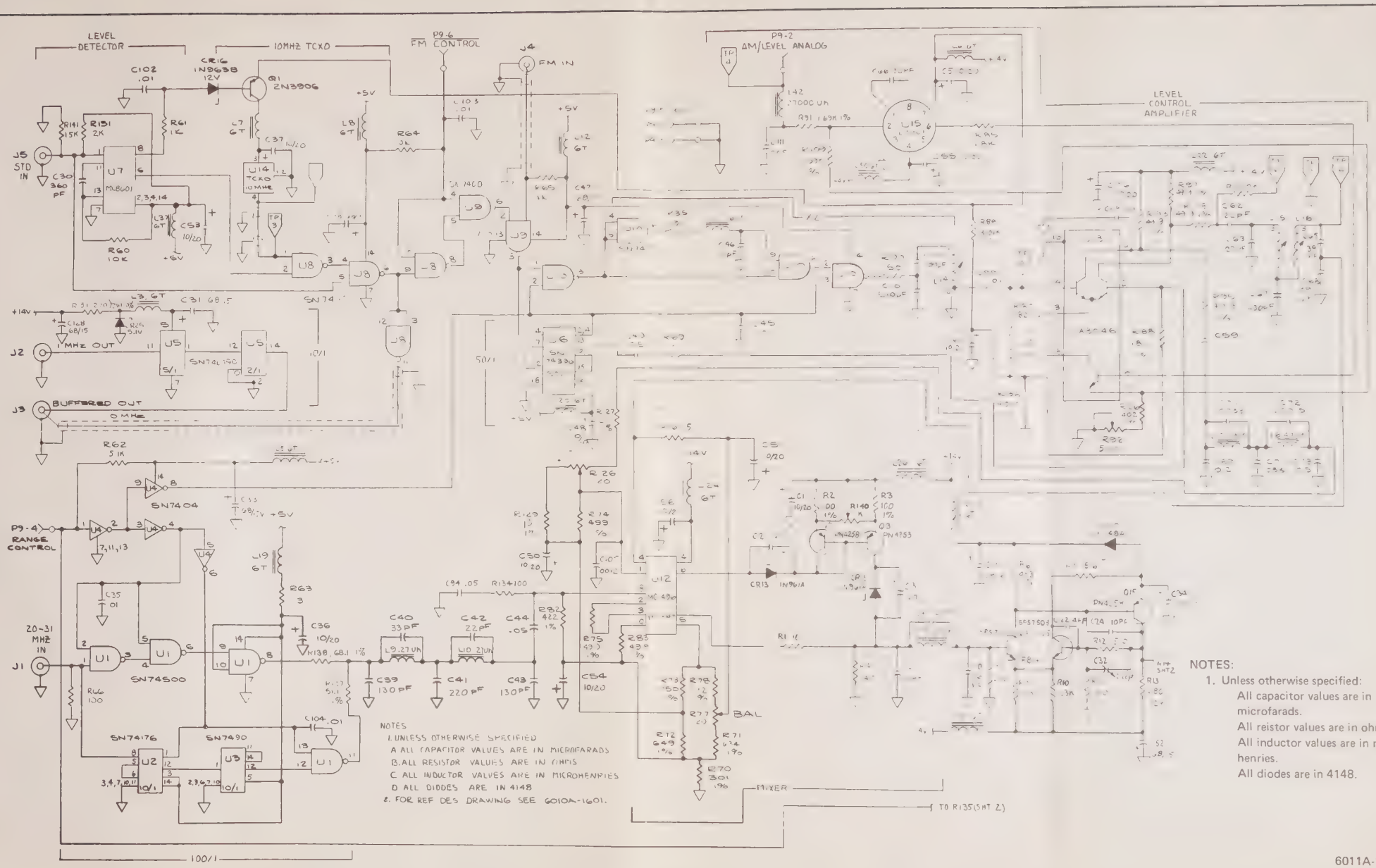


Figure 8-6. A3 Input/Output PCB Assembly (cont)

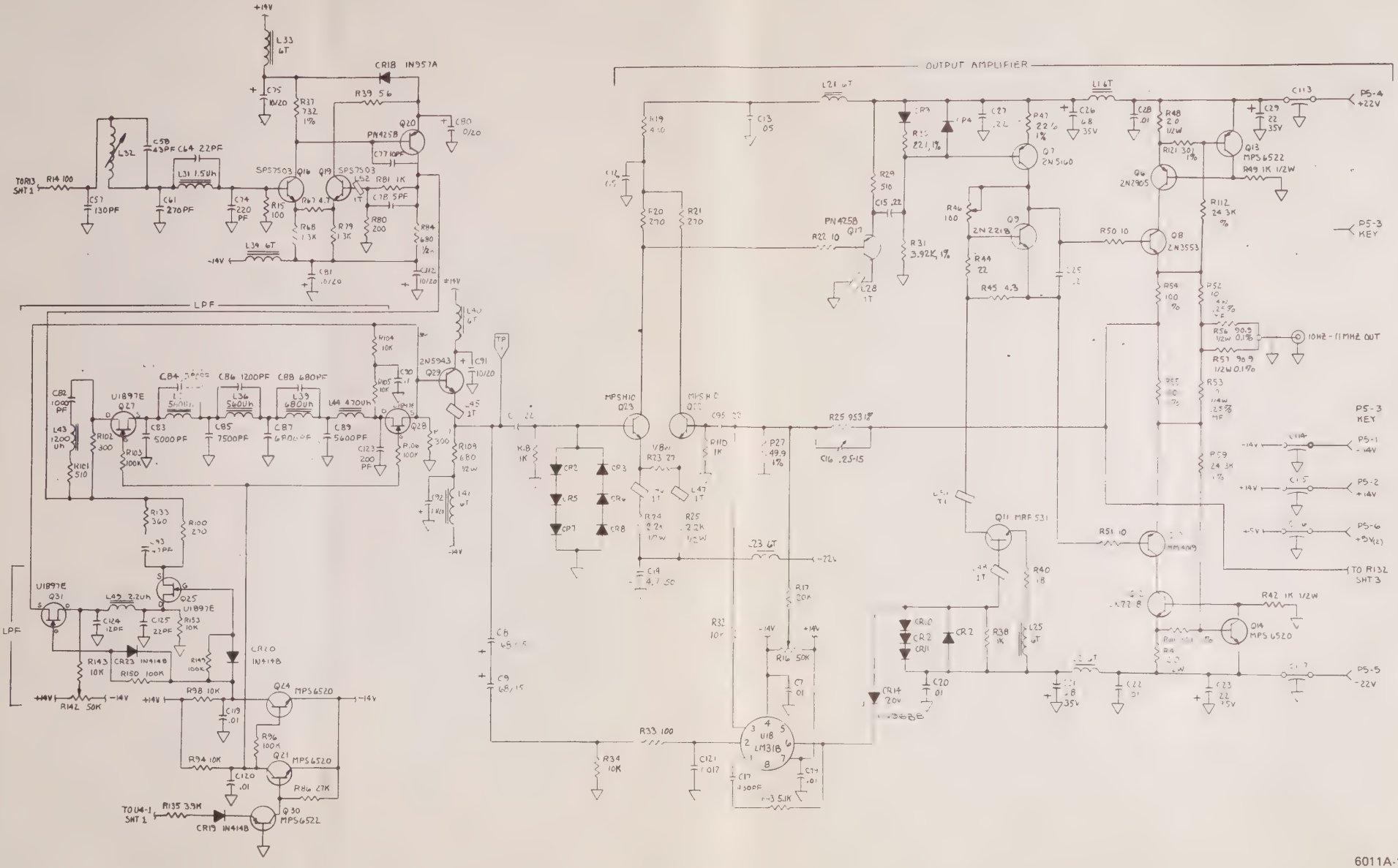
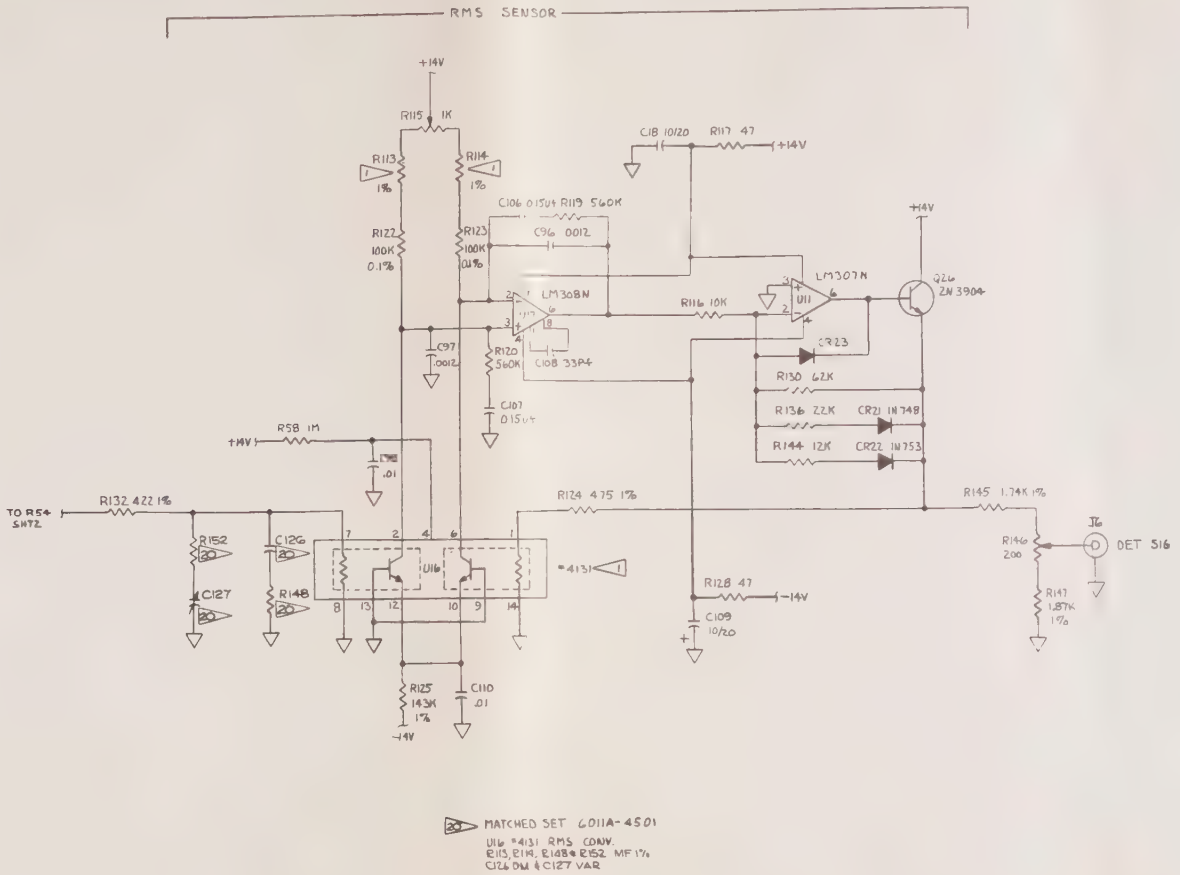


Figure 8-6. A3 Input/Output PCB Assembly (cont)



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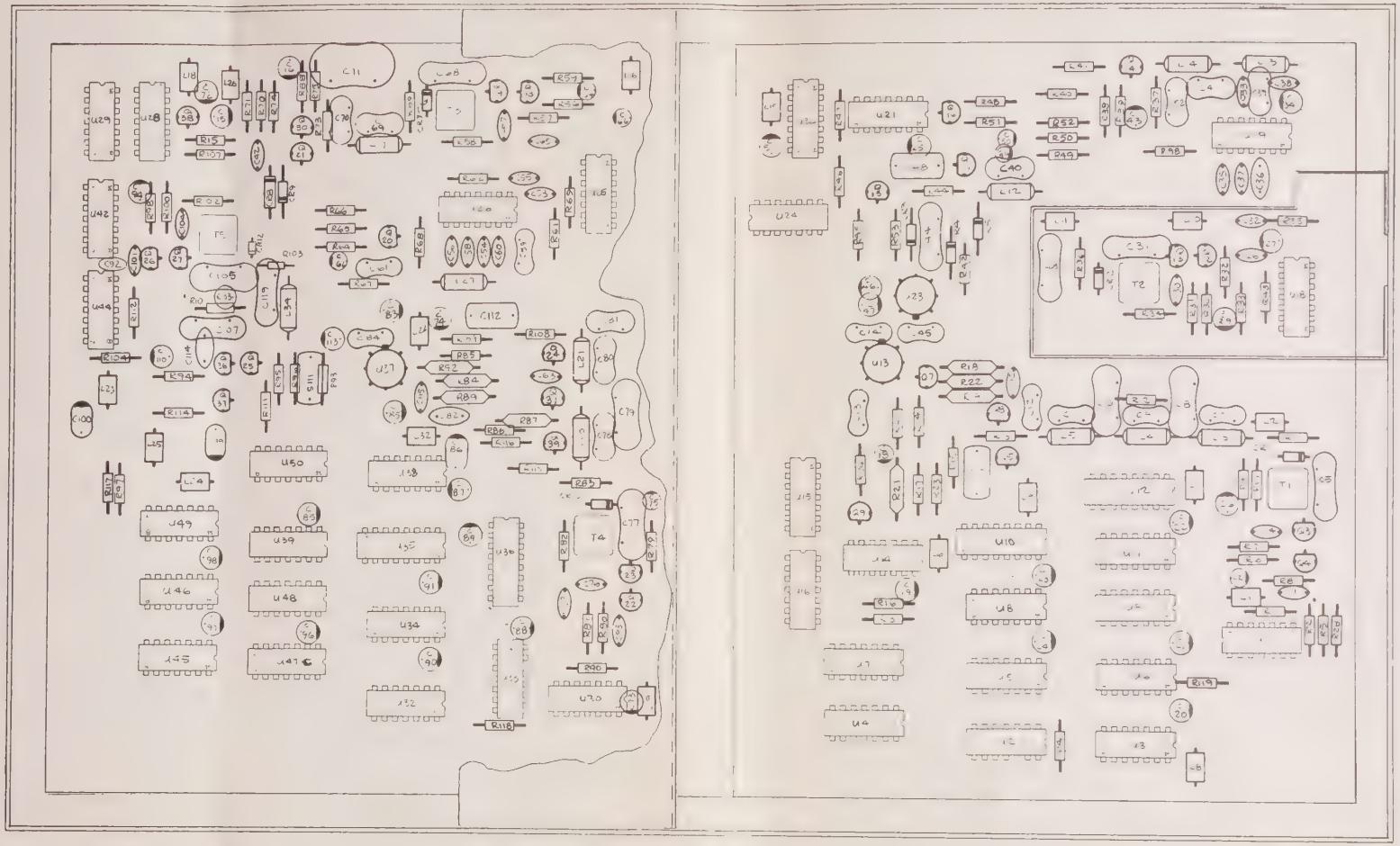
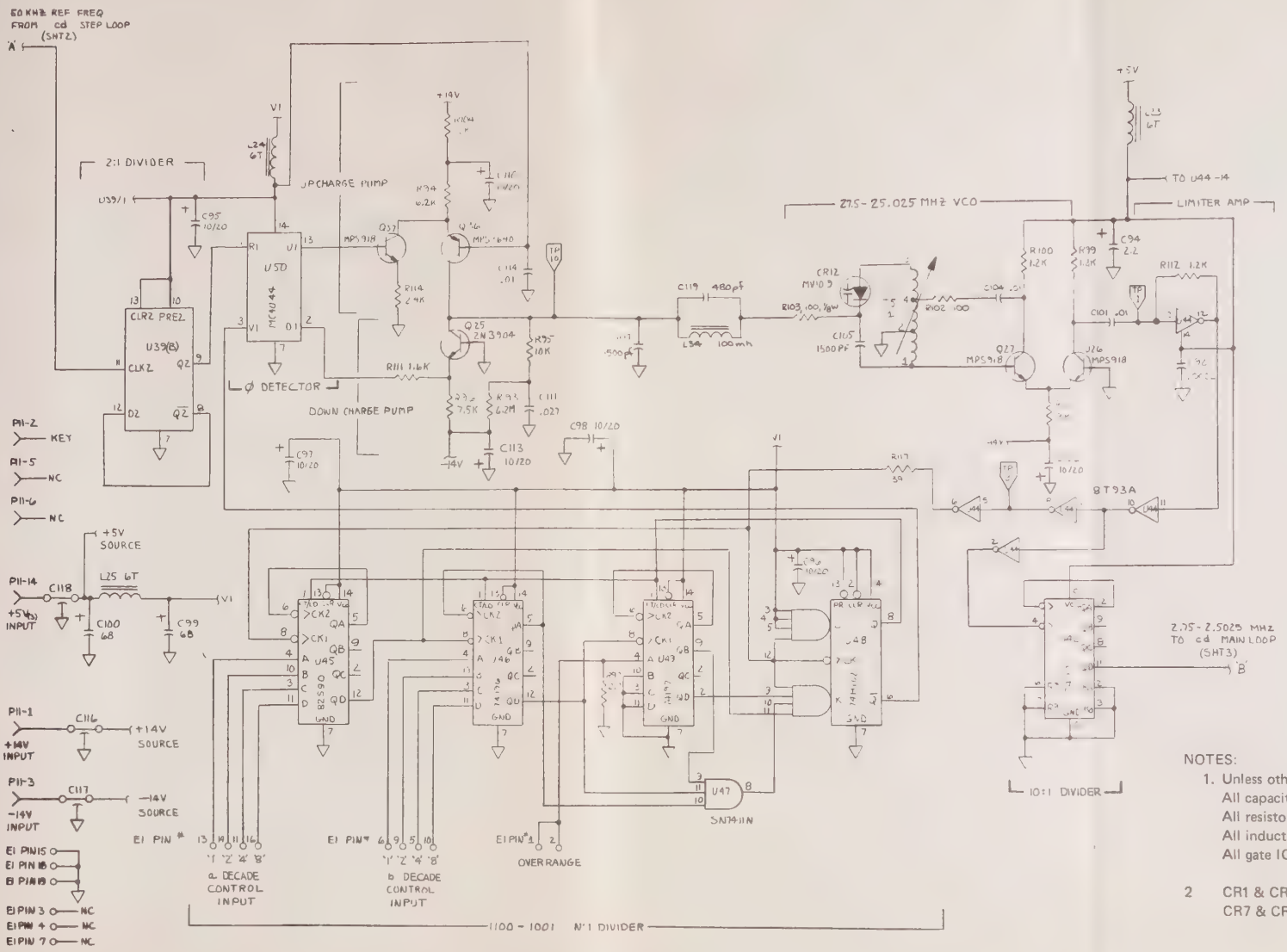
(Sheet 3 of 3)

Figure 8-6. A3 Input/Output PCB Assembly (cont)



6010A-1602

Figure 8-7. A4 Six-Digit Generator PCB Assembly



NOTES:

1. Unless otherwise specified:
   All capacitor values are in microfarads.
   All resistor values are in ohms.
   All inductor values are in microhenries.
   All gate IC's: pin 14 - filtered +5V.
   pin 7 - ground.
2. CR1 & CR2 are a matched pair.
   CR7 & CR10 are a matched pair.

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(Sheet 1 of 5)

Figure 8-7. A4 Six-Digit Generator PCB Assembly (cont)

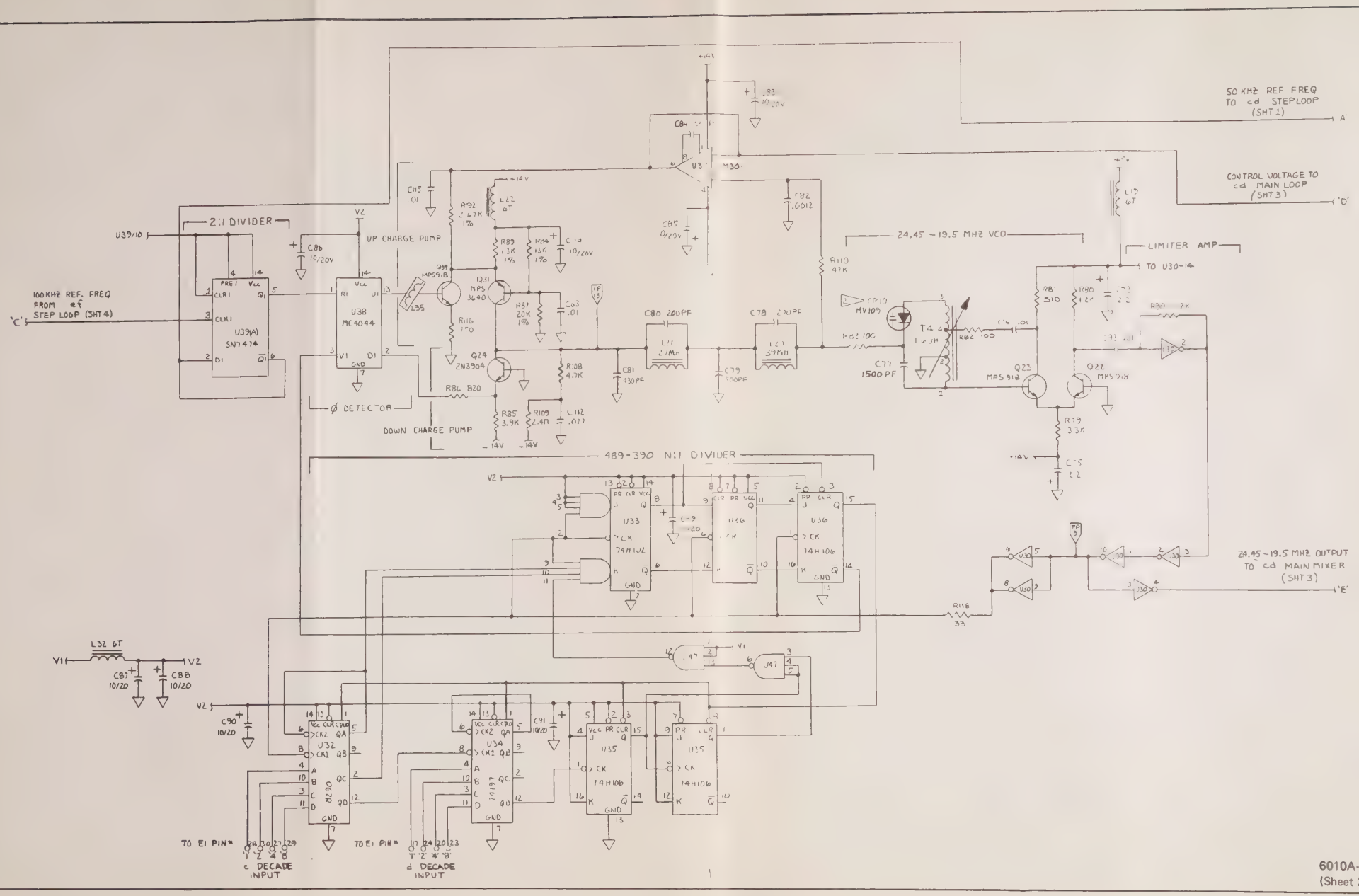
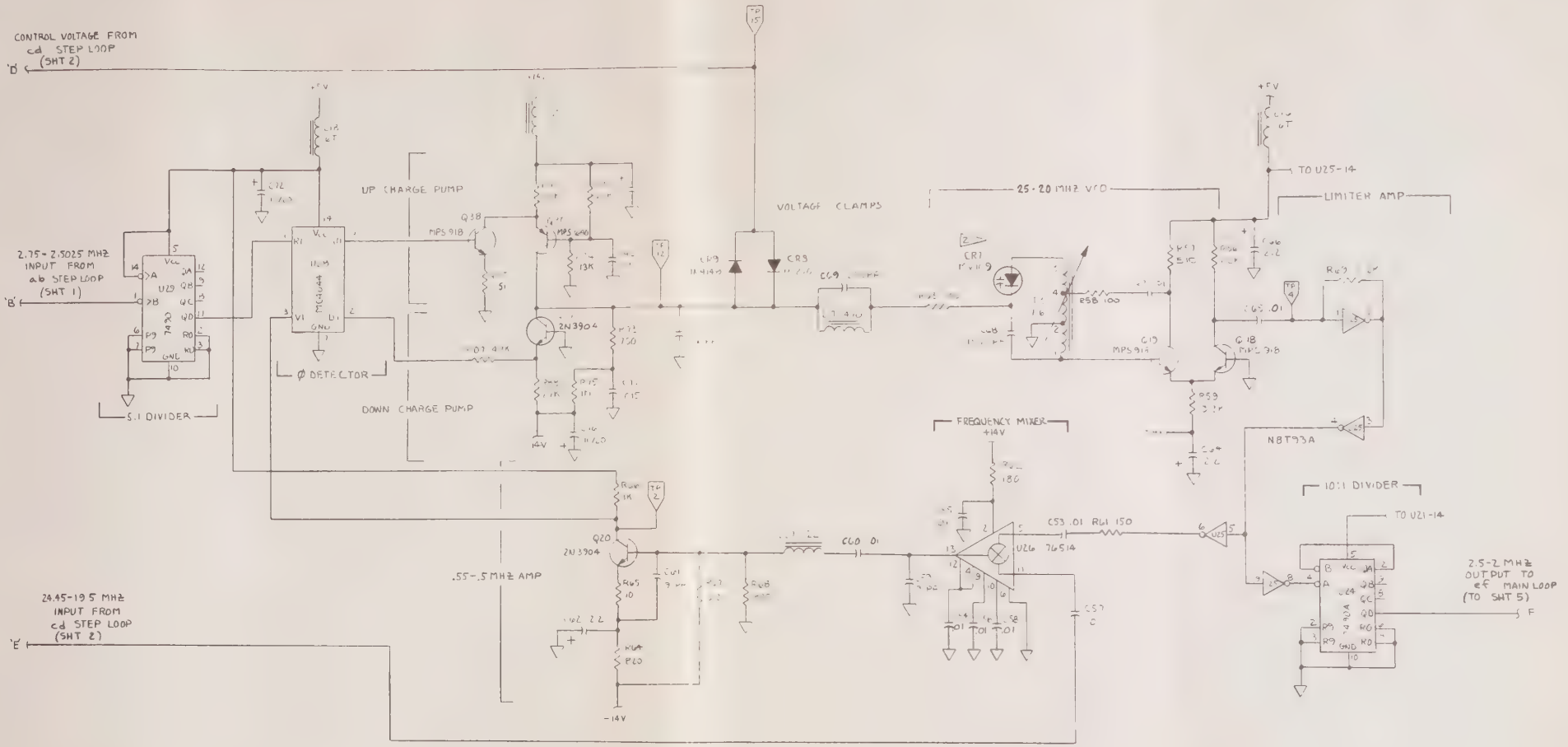


Figure 8-7. A4 Six-Digit Generator PCB Assembly (cont)



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(Sheet 3 of 5)

Figure 8-7. A4 Six-Digit Generator PCB Assembly (cont)

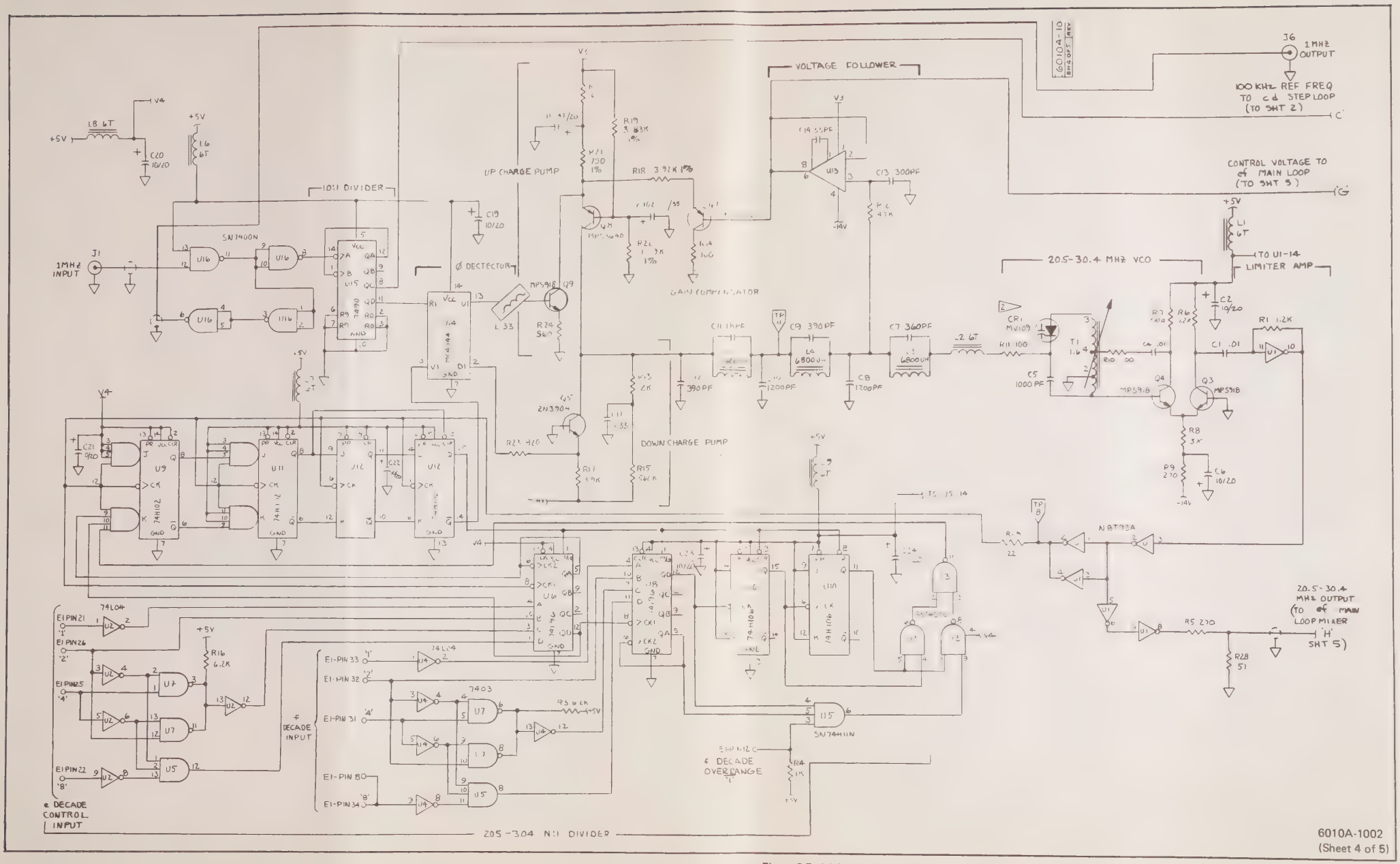
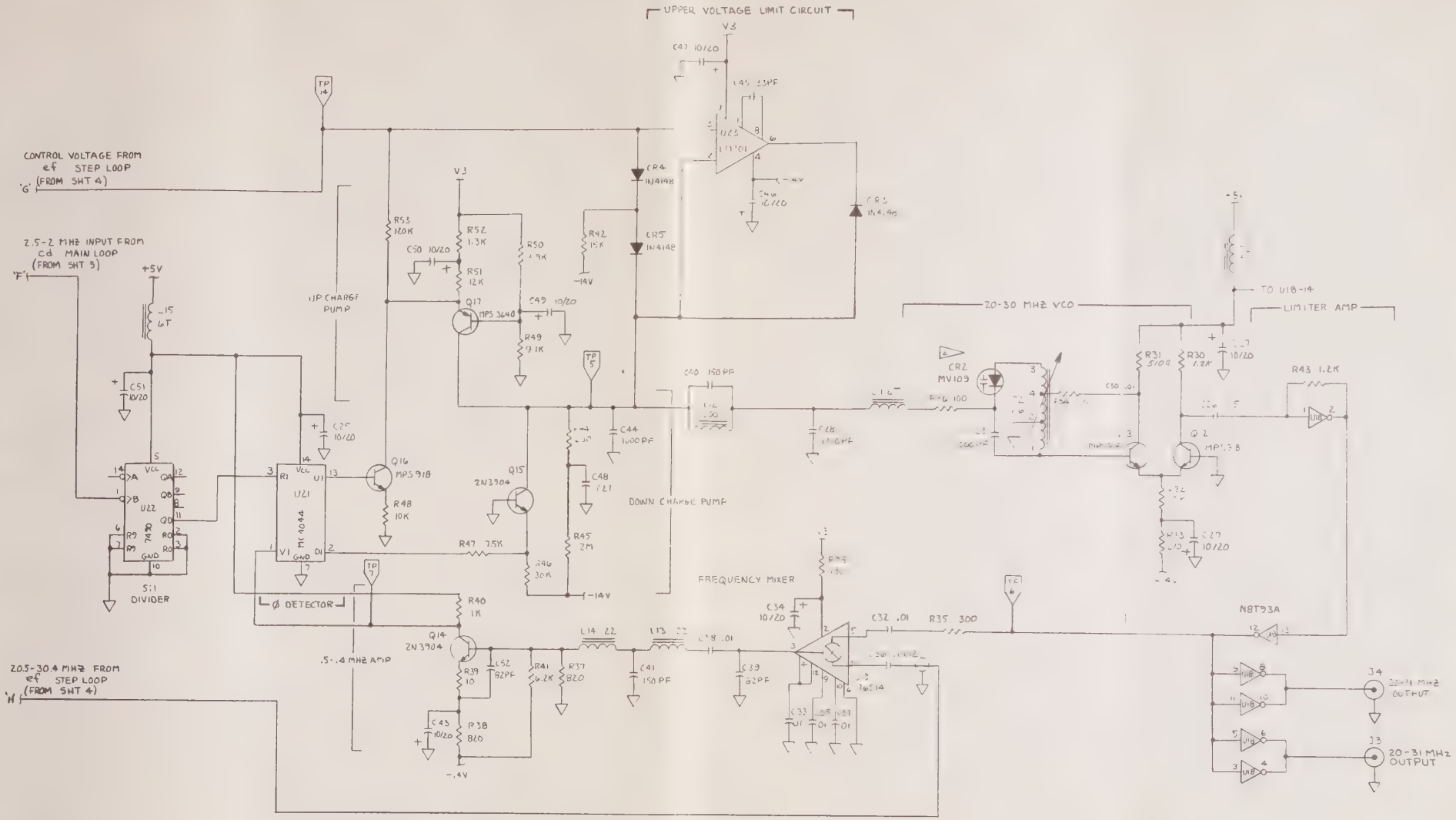


Figure 8-7. A4 Six-Digit Generator PCB Assembly (cont)



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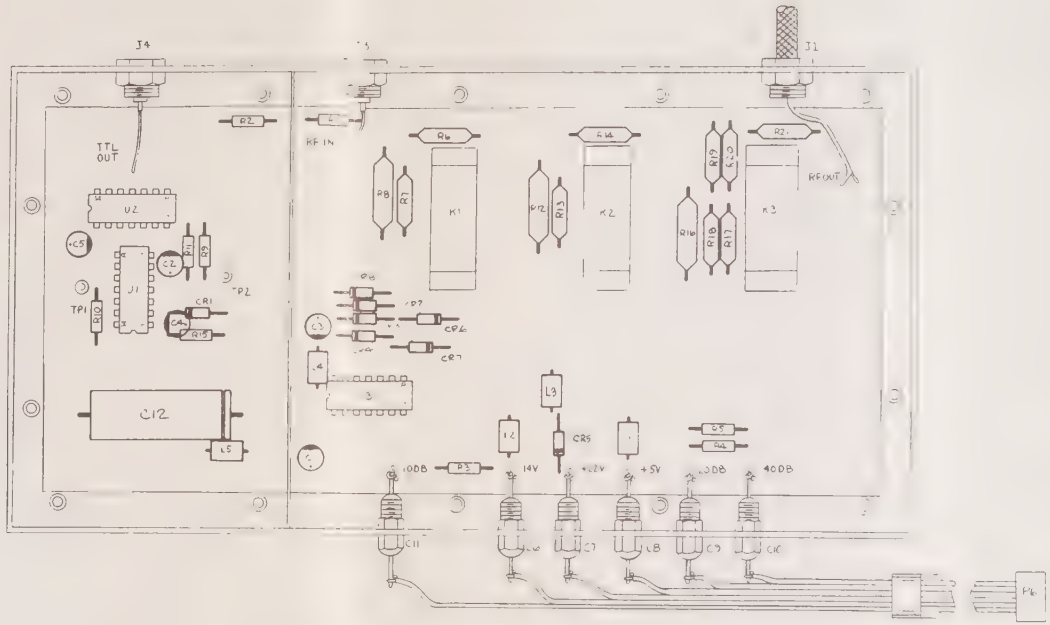
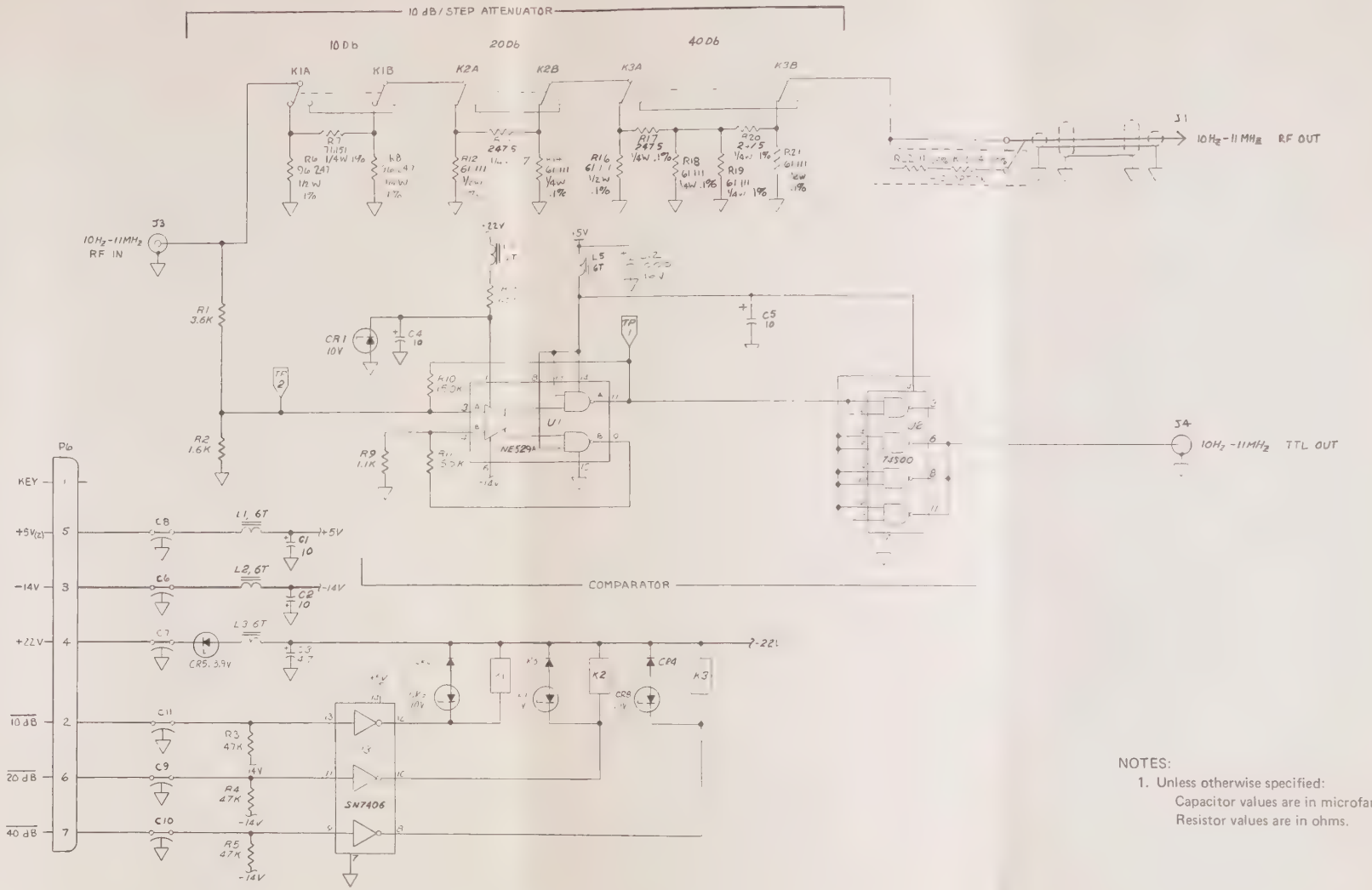
(Sheet 5 of 5)

Figure 8-7. A4 Six-Digit Generator PCB Assembly (cont)



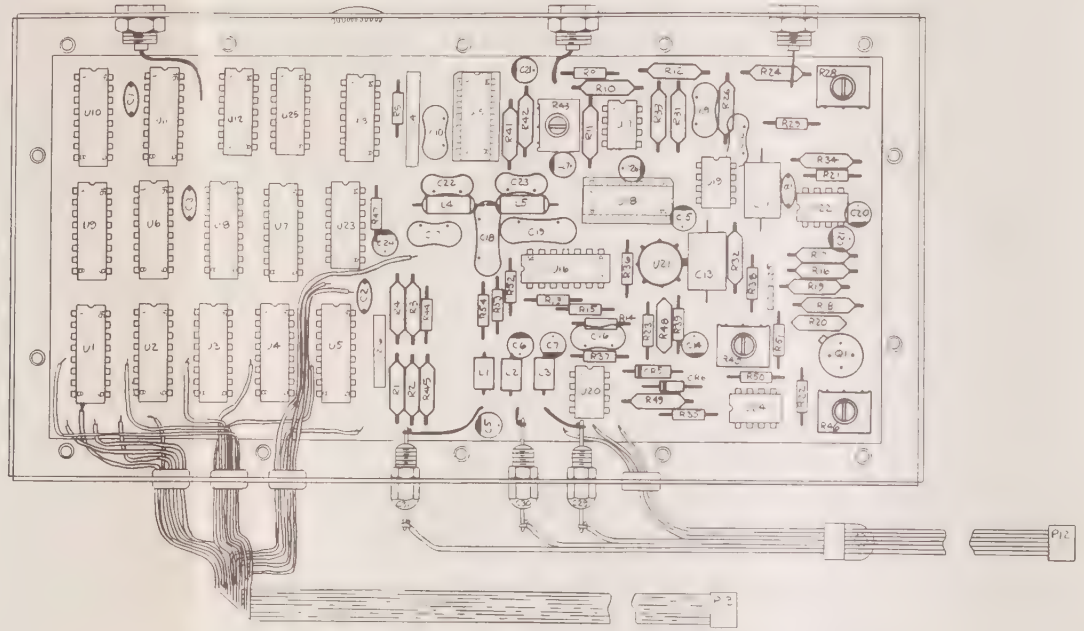
6011A-1603

Figure 8-8. A5 Attenuator PCB Assembly



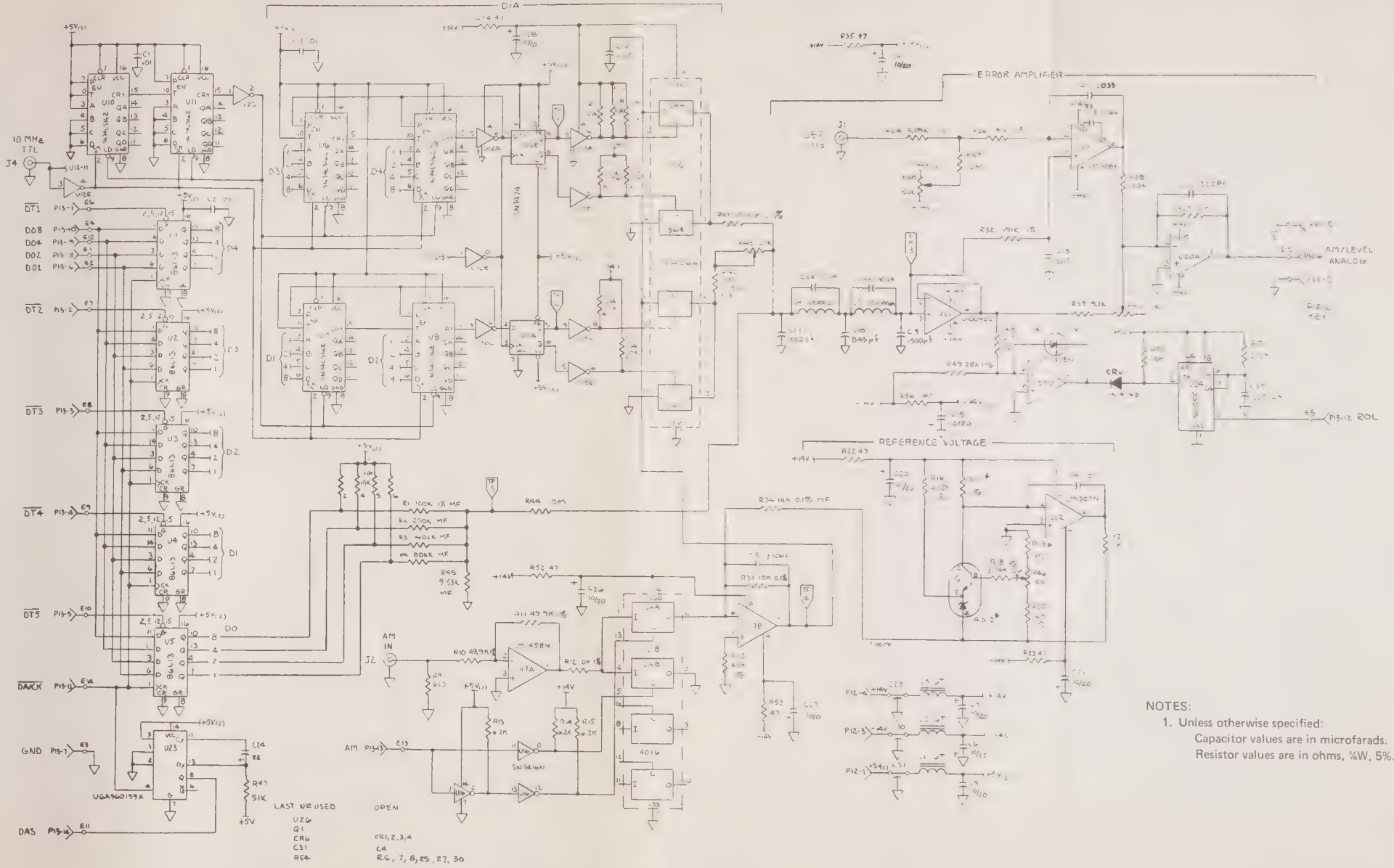
6011A-1003

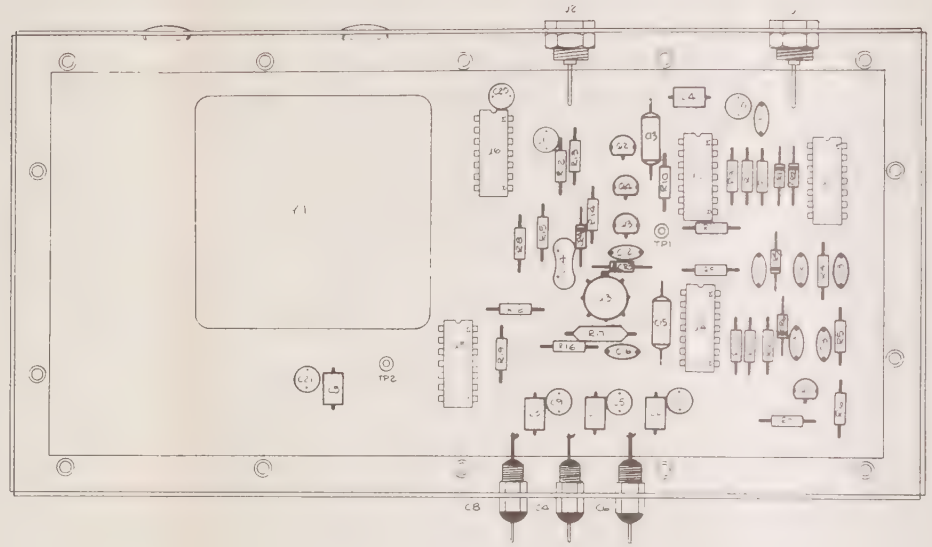
Figure 8-8. A5 Attenuator PCB Assembly (cont)



6011A-1609

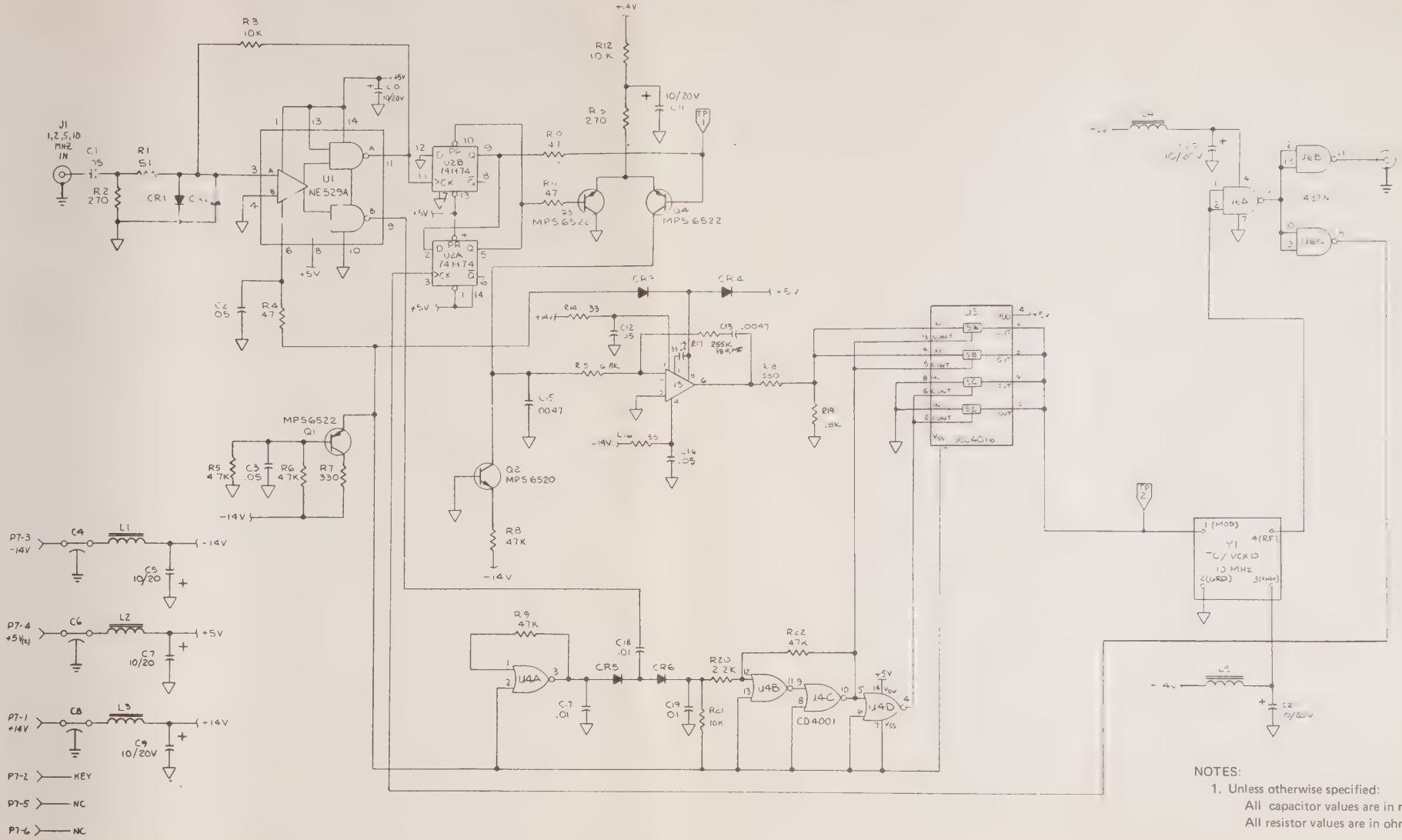
Figure 8-9. A6 Amplitude D/A PCB Assembly


D/A
ERROR AMPLIFIER
REFERENCE VOLTAGE
10 MHz TTL
J4
AM IN
J2
AM/LEVEL ANALOG
P13-12 ROL
GND P13-7
DAS P13-14
DANCK P13-11
DT1 P13-1
DT2 P13-2
DT3 P13-3
DT4 P13-4
DT5 P13-5
D08 P13-10
D04 P13-9
D02 P13-8
D01 P13-6
AM P13-13
SW8
SW7
SW6
SW5
SW4
SW3
SW2
SW1
R1 100K 1% MF
R2 200K MF
R3 402K MF
R4 806K MF
R45 953K MF
R49 .0M
R34 14K 0.1% MF
R31 10K 0.1%
R32 .191K 1%
R39 9.1K
R22 47
R52 47
R23 47
R47 51K
R9 6.04
R10 49.9K 1%
R11 49.9K 1%
R12 .0K 1%
R13 6.2K
R14 6.2K
R15 6.2K
R16 10K
R18 10K
R35 47
R36 9.09K
R37 10K
R38 10K
R40 10K
R41 10K
R42 10K
R43 10K
R44 10K
R46 10K
R48 10K
R50 10K
R51 10K
R53 47
R54 10K
C1 .01
C2 10/20
C3 .01
C4 .01
C5 .01
C6 .01
C7 .01
C8 .01
C9 1500pf
C10 .01
C11 .01
C12 .01
C13 .01
C14 .01
C15 .01
C16 .01
C17 .01
C18 .01
C19 .01
C20 .01
C21 .01
C22 .01
C23 .01
C24 .01
C25 .01
C26 10/20
C27 .01
C28 .01
C29 .01
C30 .01
C31 .01
C32 .01
C33 .01
C34 .01
C35 .01
C36 .01
C37 .01
C38 .01
C39 .01
C40 .01
C41 .01
C42 .01
C43 .01
C44 .01
C45 .01
C46 .01



6010A-1606

Figure 8-10. –02 Option, Phase Locked Input PCB Assembly

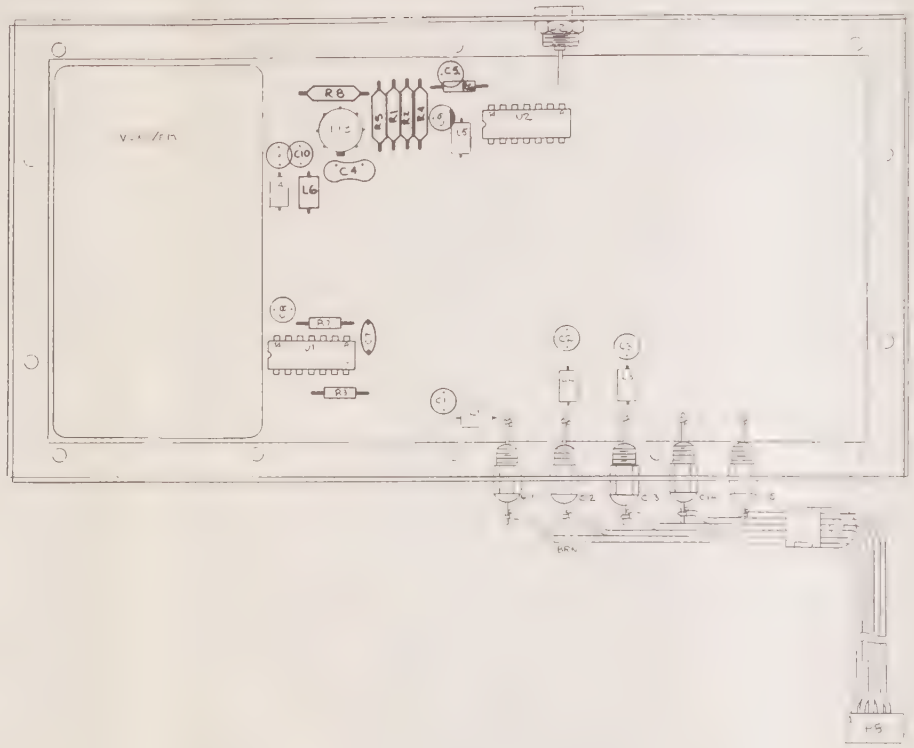


NOTES:

1. Unless otherwise specified:
   All capacitor values are in microfarads.
   All resistor values are in ohms.

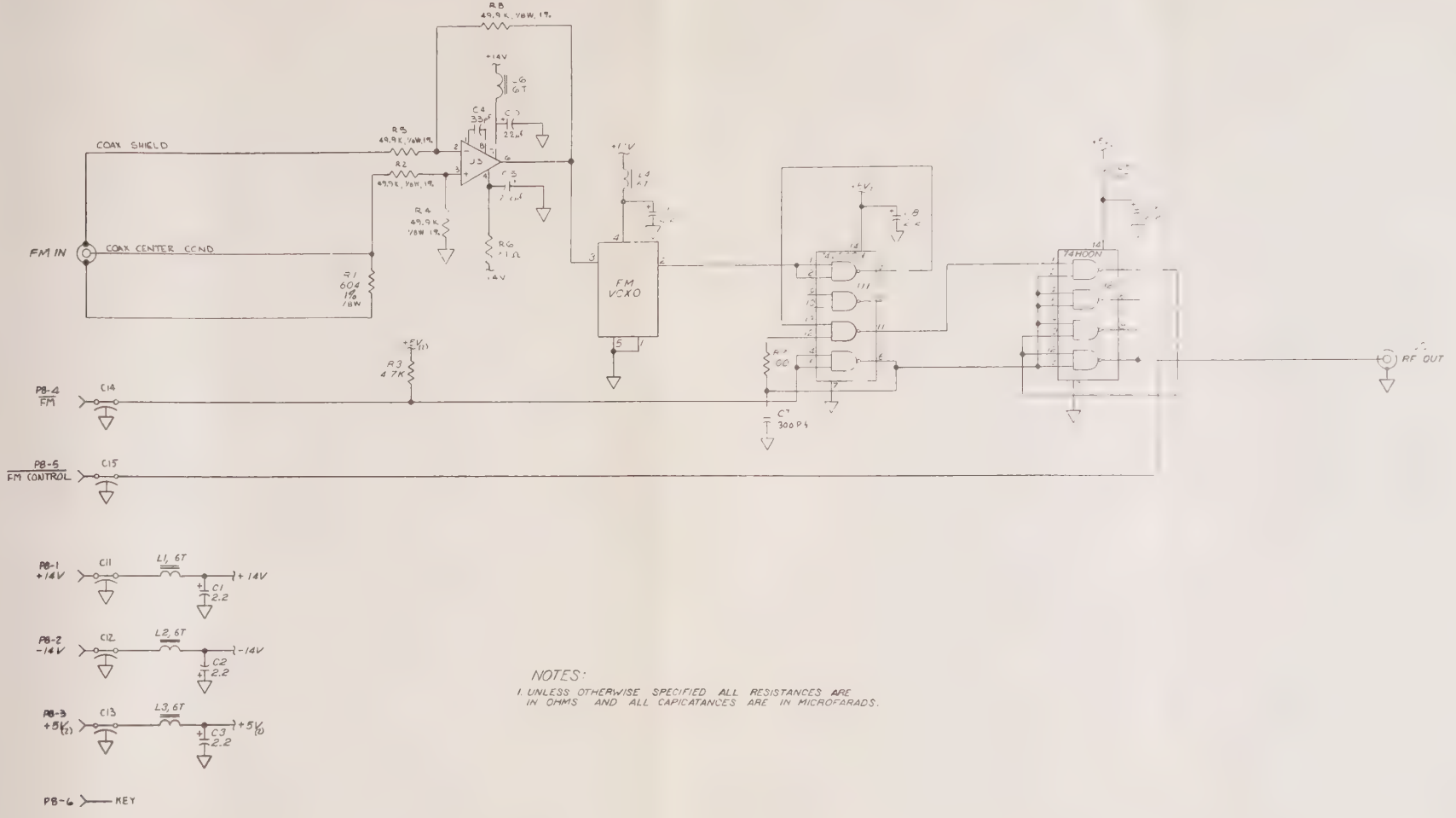
6010A-1006

Figure 8-10-. –02 Option, Phase Locked Input PCB Assembly (cont)



6010A-1607

Figure 8-11. –03 Option, FM Oscillator PCB Assembly

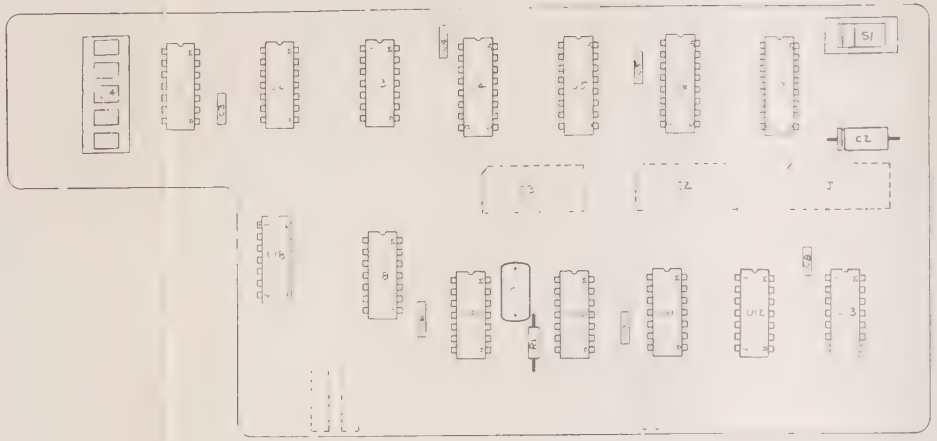


NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPICATANCES ARE IN MICROFARADS.

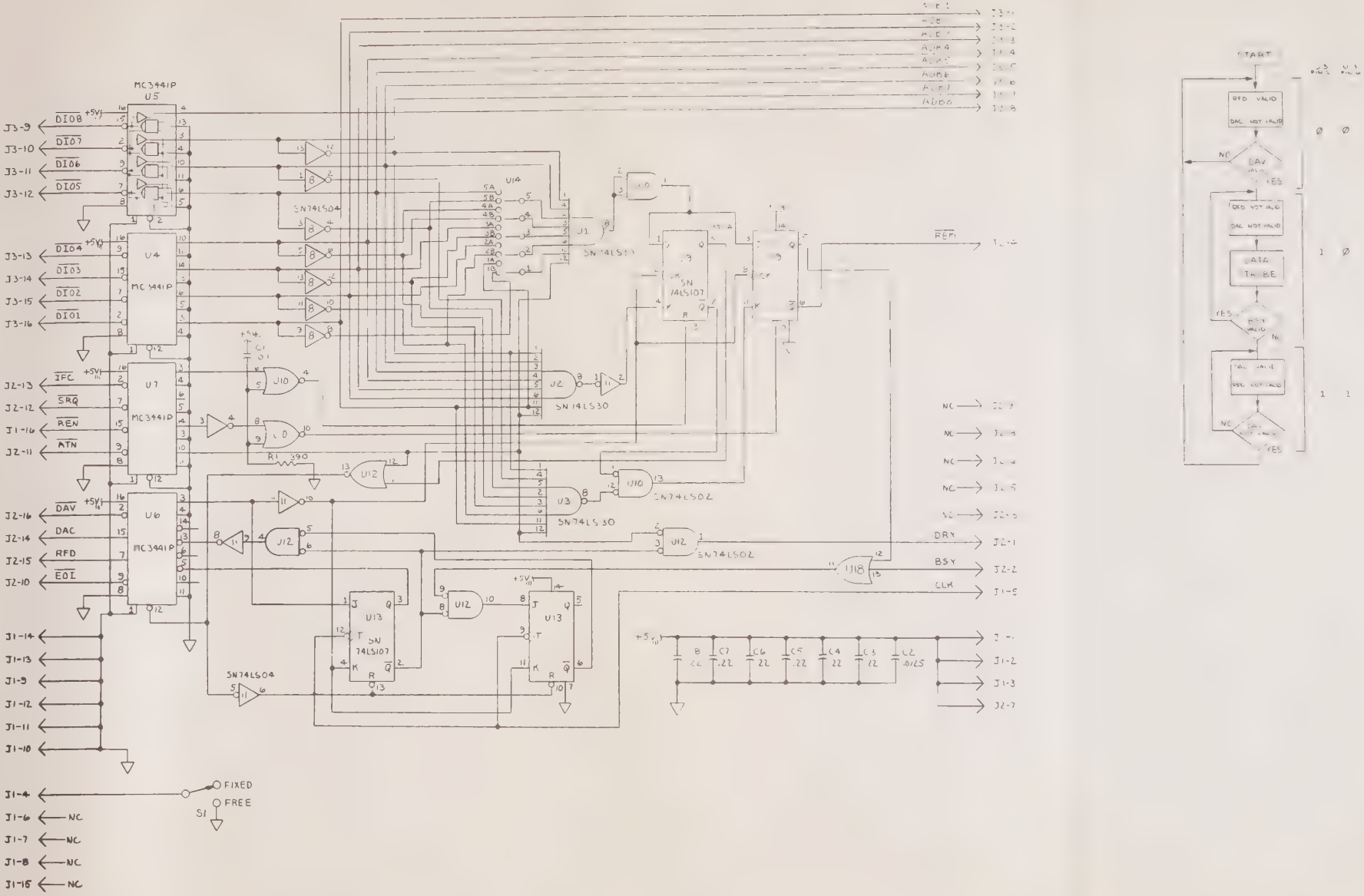
6010A-1007

Figure 8-11. –03 Option, FM Oscillator PCB Assembly (cont)



6010A-1608

Figure 8-12. –05 Option, IEEE 488-1975 Interface PCB Assembly



6010A-1008

Figure 8-12. –05 Option, IEEE 488-1975 Interface PCB Assembly (cont)

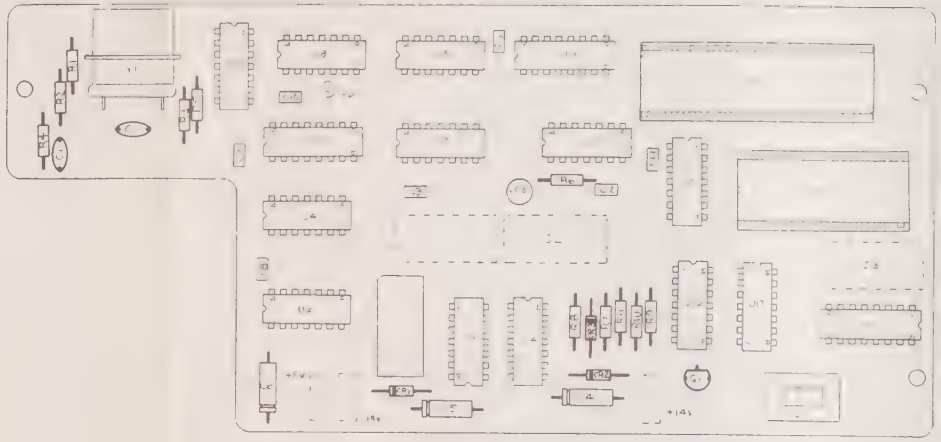


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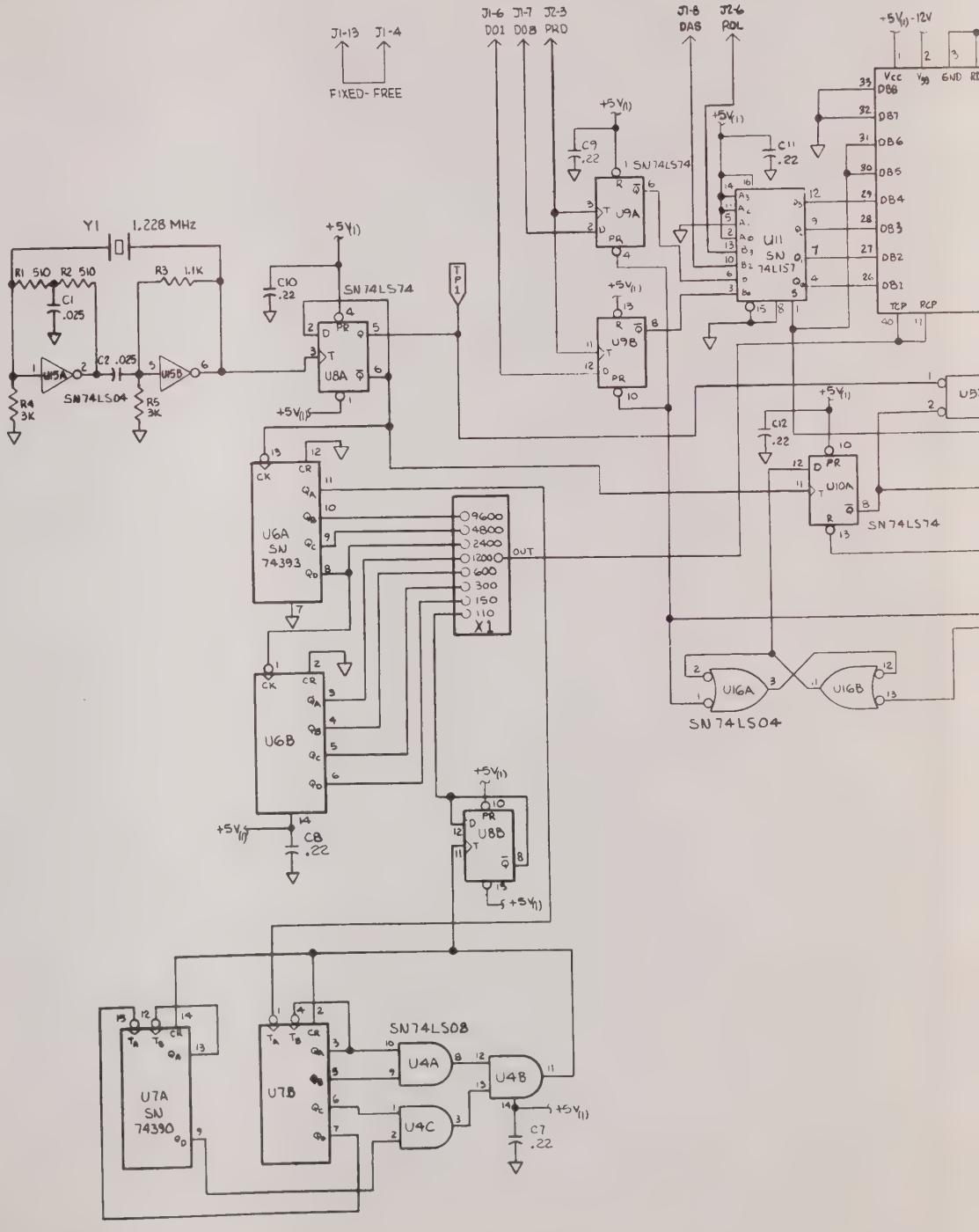
Figure 8-13. –06 Option, RS-232-C Interface PCB Assembly


J1-13 J1-4
FIXED-FREE
J1-6 J1-7 J2-3
DO1 DO8 PRD
J1-8 J2-6
DAS RDL
+5V(1) -12V
Vcc V GND
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
TCP RCP
Y1 1.228 MHz
R1 510 R2 510
C1 .025
R3 1.1K
C2 .025
R4 3K
R5 3K
U5A U5B
SN74LS04
C10 .22
SN74LS74
U8A
TP1
C9 .22
U9A
U9B
U11 SN 74LS157
C11 .22
C12 .22
U10A
U10B
U6A SN 74393
U6B
9600
4800
2400
1200
600
300
150
110
OUT
X1
U16A U16B
SN74LS04
C8 .22
U8B
C7 .22
SN74LS08
U4A U4B U4C
U7A SN 74390
U7B

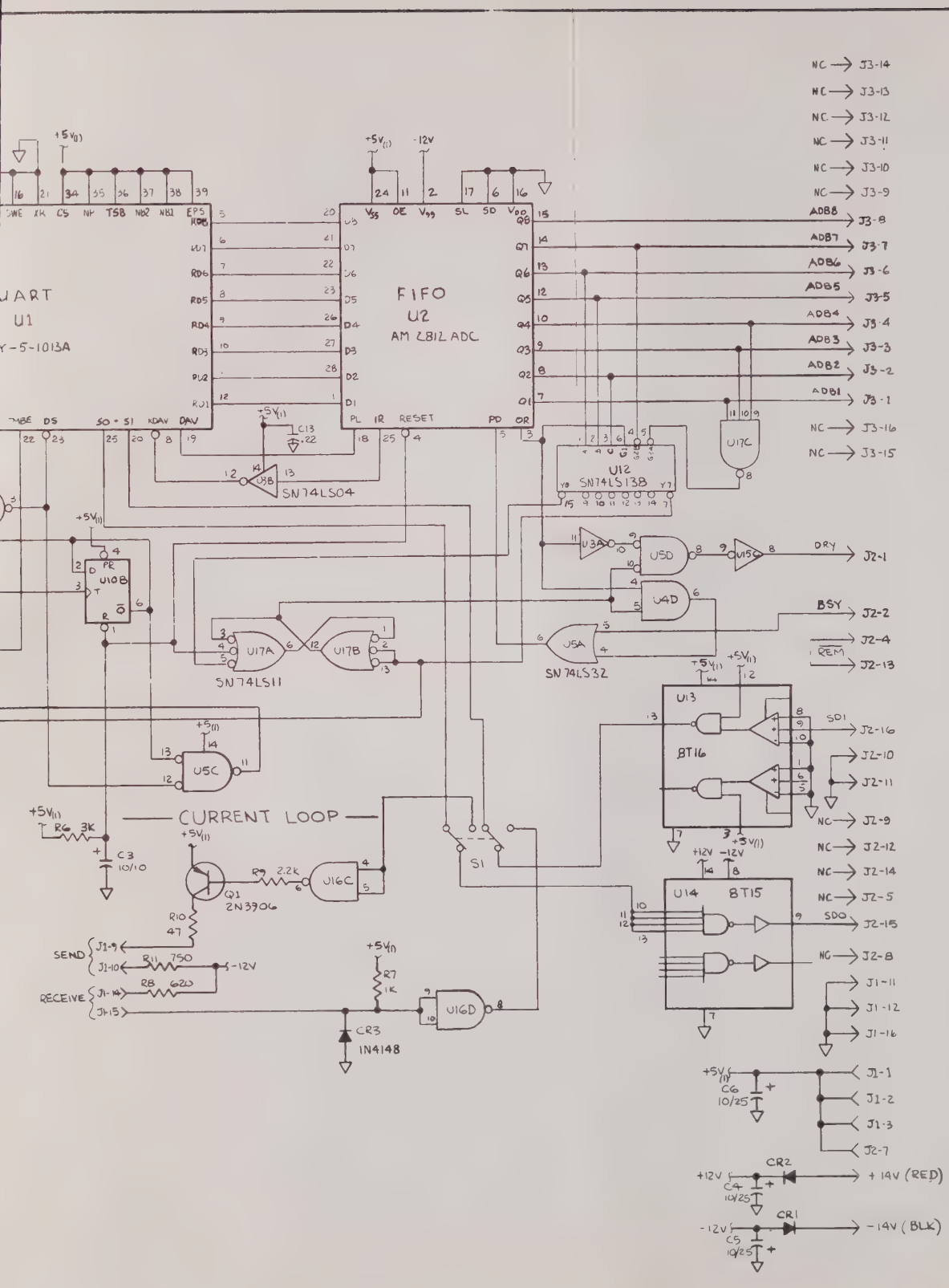
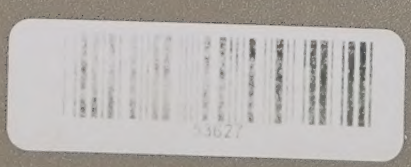


Figure 8-13. –06 Option, RS-232-C Interface PCB Assembly (cont)



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